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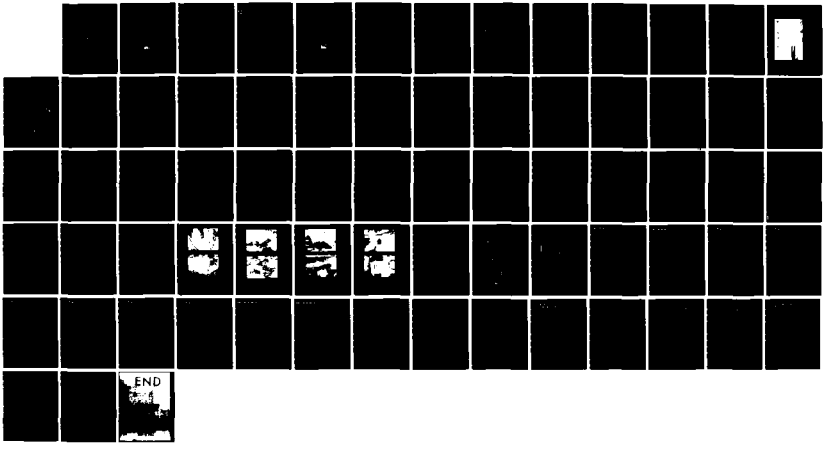

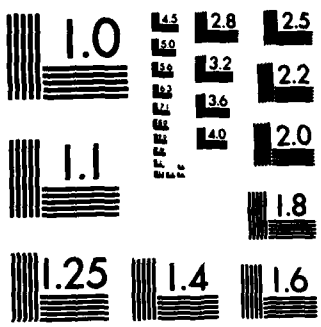

THAMES RIVER BASIN
SPRAGUE, CONNECTICUT

VERSAILLES POND DAM
CT 00472

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST, 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00472	2. GOVT ACCESSION NO. AD-A144 581	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Versailles Pond Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE August 1980 13. NUMBER OF PAGES 50
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Thames River Basin
Sprague, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This project has a total length of approximately 400 feet, consisting of a 184 foot long broad-crested masonry spillway, a 190 foot long earth embankment, and a 27 foot long sluiceway. Based upon the visual inspection at the site and past performance, the project is judged to be in poor condition. It is classified as a significant hazard, intermediated size dam. The test flood range to be considered is from one-half to full PMF.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

JAN 07 1981

Honorable William A. O'Neill
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Versailles Pond Dam (CT-00472) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Federal Paper Board Co., Inc., Sprague, CT 06330.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

Incl
As stated

THAMES RIVER BASIN
SPRAGUE, CONNECTICUT

VERSAILLES POND DAM
CT 00472

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST, 1980

BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	VERSAILLES POND DAM
Inventory Number:	CT 00472
State:	CONNECTICUT
County:	NEW LONDON
Town:	SPRAGUE
Stream:	LITTLE RIVER
Owner:	FEDERAL PAPER BOARD CO. INC.
Date of Inspection:	JUNE 2, 1980
Inspection Team:	PETER HEYNEN, P.E.
	HECTOR MORENO, P.E.
	THEODORE STEVENS
	ROBERT JAHN

This project, built around 1920, has a total length of approximately 400 feet, consisting of a 184 foot long broad-crested masonry spillway, a 190 foot long earth embankment, and a 27 foot long sluiceway (See Sheet B-1). The top of the embankment, at elevation 88.7, is approximately 20 feet wide, 8.7 feet above the spillway crest, and 23 feet above the streambed of the Little River. With the pond level to the top of the dam, the pond impounds approximately 1000 acre-feet of water. The sluiceway at the left end of the dam leads to abandoned factory buildings about 400 feet from the dam. The intake to the sluiceway is a wood bulkhead, which contains 5 gates.

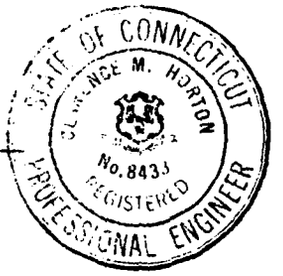
Based upon the visual inspection at the site and past performance, the project is judged to be in poor condition. No evidence of instability of the project was observed. However, there are items which require maintenance, such as the dense vegetation on the embankment and the inoperable sluice gates.

In accordance with Army Corps of Engineers' Guidelines, Versailles Pond Dam is classified as a significant hazard, intermediate size dam. The test flood range to be considered is from one-half to full Probable Maximum Flood (PMF). The test flood for Versailles Pond Dam is equivalent to the ½ PMF. Peak inflow to the pond at the ½ PMF is 12,000 cubic feet per second (cfs); peak outflow is 12,000 cfs with the dam maintaining 0.6 foot of freeboard. The spillway capacity with the pond level to the top of the dam is 13,000 cfs, which is equivalent to 108% of the routed test flood outflow.

It is recommended that the owner retain the services of a registered professional engineer to formulate recommendations concerning removal of trees from the embankment, restoration of the sluice gate facilities, and construction of a low-level outlet. Recommendations made by the engineer should be implemented by the owner.

The above recommendations and further remedial measures presented in Section 7 should be instituted within one year of the owner's receipt of this report.

Peter M. Heynen, P.E.
Project Manager - Geotechnical
Cahn Engineers, Inc.



C. Michael Horton, P.E.
Chief Engineer
Cahn Engineers, Inc.

This Phase I Inspection Report on Versailles Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam would necessarily represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions there of. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as neccessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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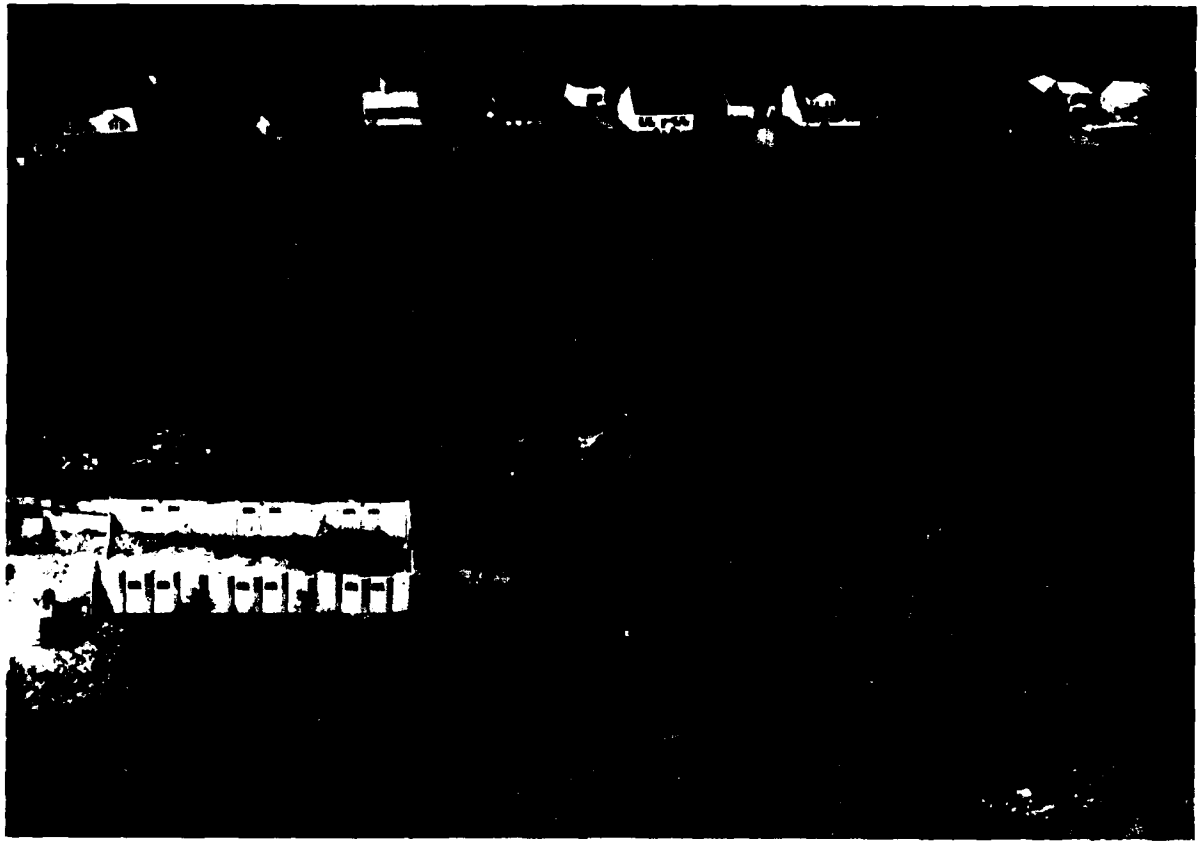
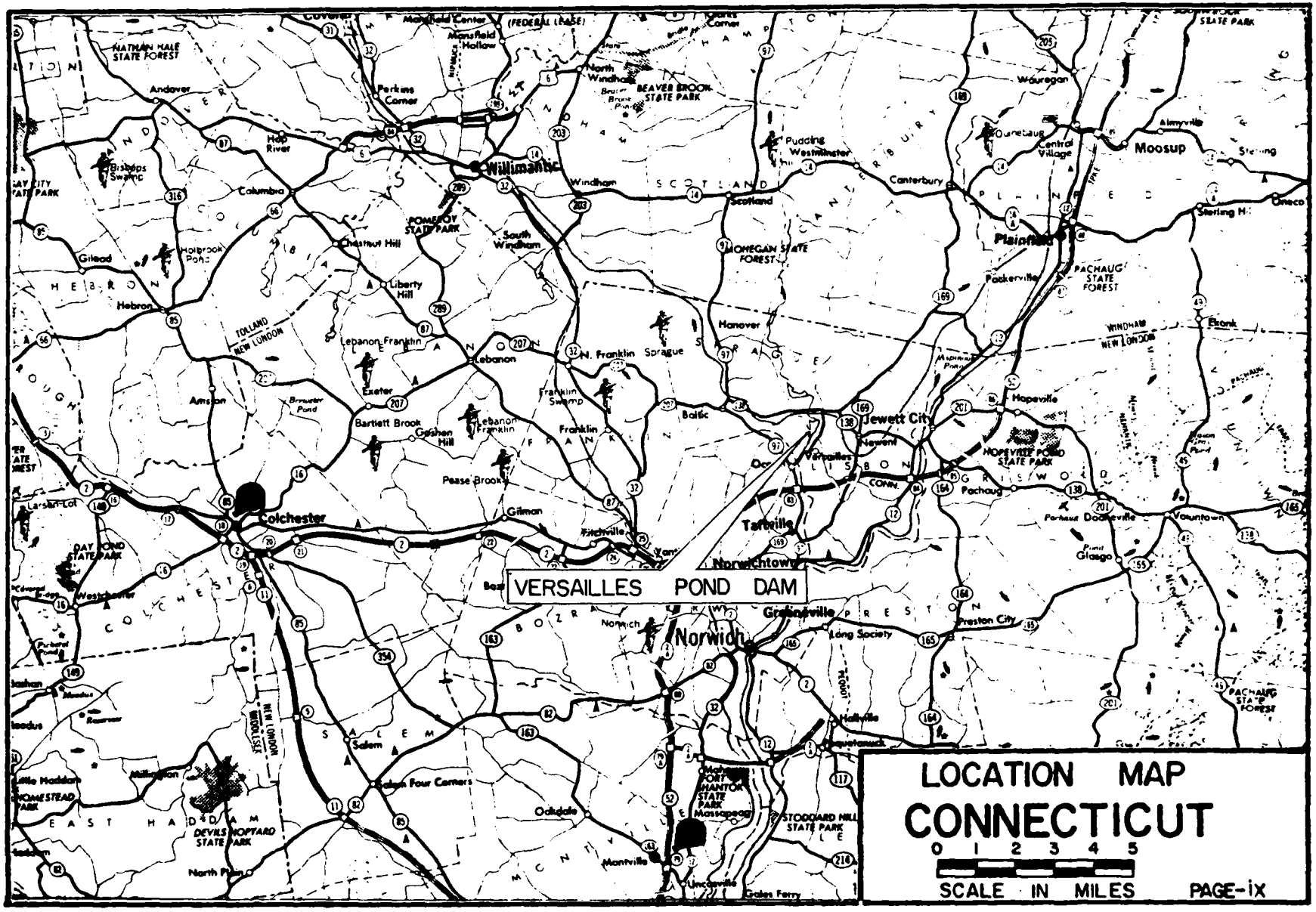
APPENDICES



OVERVIEW PHOTO
February, 1980

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF	Versailles Pond Dam	Sprague	DATE July, '80
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	INSPECTION OF NON-FED DAMS	Little River	CONNECTICUT	CE #27 785 K PAGE viii


VERSAILLES POND DAM
LOCATION MAP
CONNECTICUT
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SCALE IN MILES
PAGE-ix

PHASE I INSPECTION REPORT

VERSAILLES POND DAM

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Cahn Engineers, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Cahn Engineers, Inc. under a letter of April 14, 1980 from William E. Hodgson, Jr. Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0052 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.

2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dam.

3. To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

1. Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

2. A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

3. Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

4. An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located on the Little River in a rural area of the Town of Sprague, County of New London, State of Connecticut. The dam is shown on the Norwich USGS Quadrangle Map, having coordinates latitude N 41° 36.1' and longitude W 72° 02.7'.

b. Description of Dam and Appurtenances - As shown on Sheet B-1, the 23 foot tall dam is an earth embankment and masonry gravity structure. The dam is approximately 400 feet long, consisting of, from left to right, a 27 foot long sluiceway, a 184 foot long spillway and a 190 foot long embankment.

The spillway, with an assumed NGVD elevation of 80.0 (See Notes, Sheet B-1), is a broad-crested (6 feet wide) masonry weir of trapezoidal cross-section, with a sloping, sand bottom approach channel and a stepped downstream face. The left end of the spillway curves in a 90° arc and, for a length of 93 feet, has one foot high permanent stoplogs bolted to the crest. Stoplogs are also in place for a length of 14 feet at the right end of the spillway, leaving 77 feet of the straight part of the spillway without stoplogs. Spillway discharge is onto an area of dumped boulder riprap at the toe of the spillway, then to the natural cobble bottom streambed of the Little River. There is a masonry training wall at the right end of the spillway separating it from the embankment and a masonry abutment at the left end of the spillway separating it from the sluiceway.

The top of the embankment has a width of 20 feet, is 8.7 feet above the spillway crest, and has an approximately 8 foot tall chain link fence along it axis. The upstream and downstream slopes have approximate inclinations of 2 horizontal to 1 vertical, but the downstream slope flattens somewhat near the toe.

The sluiceway at the left end of the dam is 27 feet wide and bridged by a wooden bulkhead which houses 5 sluice gates. The bottom of the channel on the upstream side of the bulkhead is approximately 6 feet below the spillway crest and vertical masonry walls line the channel. An earth cofferdam had previously blocked the intake channel, but has now been breached and appears as an island.

c. Size Classification - (INTERMEDIATE) - The dam impounds approximately 1000 acre-feet of water with the reservoir level to the top of the dam, which is 23 feet above the streambed of the Little River. According to recommended guidelines, a dam with a maximum storage of 1000 acre-feet is classified as intermediate in size.

d. Hazard Classification - (SIGNIFICANT) - If the dam were breached, there is potential for loss of a few lives and substantial property damage to four houses on the left bank of the Little River approximately 1000 feet downstream of the dam (Sheet D-2 & Appendix D-7).

e. Ownership - Federal Paper Board Co. Inc.
Sprague Ct. 06330
(203) 822-8201

The dam was originally built, owned and operated by the Bay Company - Division of Park Davis Company. The present owner acquired the property in the early 1960's.

f. Operator - Mr. Robert Charette
Engineering Department
Federal Paper Board Co. Inc.
(203) 822-8201

g. Purpose of Dam - The dam was originally used to provide power to the Park Davis factory. Presently, the dam has no specific purpose, other than the retention of water rights on the Little River by Federal Paper Board.

h. Design and Construction History - There is no record of the original construction or changes to the dam until 1970 when a portion of the stoplogs on the spillway crest were removed and a cofferdam blocking the sluiceway intake was constructed. The cofferdam was subsequently breached in order to provide flow beneath the old factory to the factory tailrace channel, where sewage is entering the channel and must be diluted.

i. Normal Operational Procedures - There are no operational procedures followed at the dam, other than allowing flow to go through the broken bulkhead and sluice gates, beneath the factory to the factory tailrace channel.

1.3 PERTINENT DATA

a. Drainage Area - The drainage area is 43.6 square miles of mostly undeveloped, wooded, rolling terrain. Hampton Reservoir and Pine Acres Lake are located near the headwaters of the watershed. Hanover Reservoir and Paper Mill Pond are both located on the Little River less than 4 miles upstream of Versailles Pond Dam.

b. Discharge at Damsite - Discharge at the project is over the spillway and through the 5 sluice gate openings at the left end of the dam.

1. Outlet Works - five 4'x±6' sluices:	2000± cfs (with U/S water level at top of dam)
2. Maximum known flood at damsite:	2800 cfs (Sept. 21, 1938)
3. Ungated spillway capacity @ top of dam el. 88.7:	13,000 cfs

4. Ungated spillway capacity @ test flood el. 88.1:	12,000 cfs
5. Gated spillway capacity @ normal pool:	N/A
6. Gated spillway capacity @ test flood:	N/A
7. Total spillway capacity @ test flood el. 88.1:	12,000 cfs
8. Total project discharge @ top of dam el. 88.7:	15,000 cfs
9. Total project discharge @ test flood el. 88.1:	12,000 cfs

c. Elevations - Elevations are on National Geodetic Vertical Datum (NGVD) based on assumed spillway crest elevation of 80.0 taken from Norwich USGS Quadrangle Map, 1954.

1. Streambed at toe of dam:	65.7±
2. Bottom of cutoff:	Not known
3. Maximum tailwater:	Not known
4. Normal pool:	80 5±
5. Full flood control pool:	N/A
6. Spillway crest (ungated):	80.0 (assumed datum)
7. Design surcharge (original design):	Not known
8. Top of dam:	88.7±
9. Test flood surcharge	88.1

d. Reservoir Length

1. Normal pool:	5000± ft.
2. Flood control pool:	N/A
3. Spillway crest pool:	5000± ft.
4. Top of dam pool:	5500± ft.
5. Test flood pool:	5500± ft.

e. Reservoir Storage

1. Normal pool:	340± acre-ft.
2. Flood control pool:	N/A
3. Spillway crest pool:	340± acre-ft.
4. Top of dam pool:	1000± acre-ft.
5. Test flood pool:	945± acre-ft.

f. Reservoir Surface

1. Normal pool:	60± acres
2. Flood control pool:	N/A
3. Spillway crest pool:	60± acres
4. Top of dam pool:	92± acres
5. Test flood pool:	90± acres.

g. Dam

1. Type:	Earth embankment masonry gravity section
2. Length:	400 ft.
3. Height:	23 ft.
4. Top width:	20 ft.
5. Side slopes:	2±H to 1V Upstream and Downstream
6. Zoning:	N/A
7. Impervious core:	N/A
8. Cutoff:	Not known
9. Grout curtain:	N/A
10. Other:	N/A

h. Diversion and Regulating Tunnel - N/A

i. Spillway

1. Type:	Broad-crested masonry weir with stoplogs on portion of crest

2. Length of weir:	107 ft. with stoplogs 77 ft. no stoplogs 184 ft. total length
3. Crest elevation:	80.0 (assumed datum) 81.0 - top of stoplogs
4. Gates:	N/A
5. Upstream channel:	Sloping, sand bottom
6. Downstream channel:	Dumped boulder riprap at toe of spillway, then cobble bottom river channel
7. General:	curved spillway section with stepped downstream face

j. Regulating Outlets - Five sluice gates in bulkhead at left end of dam.

1. Invert:	74.0±
2. Size:	4'x6'±
3. Description:	Wood sluice gates
4. Control mechanism:	Worm gear hoists
5. Other:	N/A

SECTION 2: ENGINEERING DATA

2.1 DESIGN DATA

The available data consists of an "Inventory Data" sheet compiled by the Connecticut State Board for the Supervision of Dams.

2.2 CONSTRUCTION DATA

No information was available.

2.3 OPERATIONS DATA

No operations records are known to exist.

2.4 EVALUATION OF DATA

a. Existing Data - Existing data was provided by the State of Connecticut Department of Environmental Protection. The owner made the project available for visual inspection.

b. Adequacy - There was no detailed engineering data available; therefore, the final assessment of this project must be based on visual inspection, performance history, hydraulic computations of spillway capacity, and approximate hydrologic judgements.

c. Validity - A comparison of record data and visual observations reveals no significant discrepancies in the record data.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General - The condition of the project is poor. The inspection revealed several items requiring maintenance. At the time of inspection, the pond level was at elevation 80.0, i.e. at the spillway crest.

b. Dam

Top of Dam - The top of the embankment is slightly irregular in elevation and heavily wooded with large trees. The chain link fence along the top of the embankment is in poor condition, with several sections knocked over and lying flat on the ground.

Upstream Slope - The upstream slope is irregular in inclination, varying from approximately 2.7 horizontal to 1 vertical to 1.4 horizontal to 1 vertical. Although riprap is sparse to non-existent on the upstream slope, it could not be determined on the basis of visual inspection if the irregularity of the slope is the result of wave action and erosion, or sloughing. It is also possible that the embankment was not graded at a constant slope at the time of its construction. There are also many large trees and brush on the slope.

Downstream Slope - The largest trees on the embankment were noted on the downstream slope. One tree, with three main trunks, was measured to be six feet across at its base (Photo 1), and another double trunked tree is approximately four feet in diameter. The downstream slope is fairly consistent in inclination at 2 horizontal to 1 vertical, but flattens to an approximately 3 horizontal to 1 vertical inclination near the toe of the slope. There is an eroded area on the slope near the spillway training wall which is a maximum of 4.5 feet deep and 12 feet wide and extends to the top of the embankment (Photo 2 & Sheet B-1). Wet areas were noted near the toe of the left end of the embankment in close proximity to the downstream channel. No points of exit of seepage from the embankment were noted and it is probable that the wetness is due to overbank flooding of the downstream channel or a natural high groundwater condition in the area, rather than from seepage through the dam.

Spillway - The masonry spillway and training walls are in good condition. Some sedimentation of the approach channel has occurred near the right end of the spillway where stoplogs are in place and flow over the spillway only occurs at elevations of one foot or more above the spillway crest. Weedy type vegetation has taken root in these sediments and in sediments along the stoplogs on the curved, left half of the spillway crest (Photo 3). Small woody type vegetation, such as maple saplings, are growing from cracks in the masonry on the stepped downstream face of the left half of the spillway (Photo 4).

Approximately 15 feet from the left end of the spillway, a slight amount of seepage through the uppermost course of the masonry was noted (Photo 6). A minor amount of seepage was observed to be emanating from a plugged, 8 inch diameter cast iron drainpipe at about the midpoint of the curve in the spillway and 7 steps down from the spillway crest. Another minor seep was noted near the base of the right spillway training wall. All seepage appeared clear.

Displacement of much of the boulder riprap at the toe of the spillway, as located on Sheet B-1, has occurred, leaving an approximately 8 foot wide space between the toe of the spillway and the riprap. There is standing water, approximately 3 feet deep, trapped in this area (Photos 4 & 5).

c. Appurtenant Structures - The outlet facilities for the dam are in poor condition (Photos 7 & 8). The sluice gates are in the closed position, but there are gaping openings in the wood bulkhead at about the elevation of the spillway crest, allowing flow to the sluiceway channel. Two of the worm gear hoists are missing, the gate hoist platforms are rotting, and the bridge over the sluiceway is unsafe. The dry laid masonry sluiceway walls are in fair condition, with some saplings growing from the wall. There is a leak in the right channel wall approximately 200 feet downstream of the bulkhead. The mortar masonry retaining wall along the left side of the sluiceway intake channel is in good condition, with only a small amount of mortar cracked or missing.

d. Reservoir Area - The land surrounding the pond is sparsely developed meadowland with paved roads along both sides of the impoundment.

e. Downstream Channel - The channel downstream from the spillway is the natural streambed of the Little River and converges with the manmade channel from the factory approximately 1,500 feet downstream of the dam.

3.2 EVALUATION

Based upon the visual inspection, the project is assessed as being in poor condition. The manner in which the features identified in Section 3.1 could influence the future condition and/or stability of the project are as follows:

1. The lack of adequate riprap on the upstream slope of the embankment could result in erosion of the slope.

2. The root systems of the large trees on the dam embankment could provide paths for seepage through the dam. Also the trees on the embankment could become uprooted, causing damage to the embankment.

3. The embankment has slightly irregular slopes and top elevation and there is an eroded area on the downstream slope.

4. Sedimentation and the growth of vegetation on the upstream side of stoplogs on the spillway crest could eventually cause constriction of the spillway approach channel.

5. Growth of woody type vegetation from the stepped downstream face of the spillway and from the sluiceway walls could eventually cause displacement of the masonry.

6. Under high flows, water turbulence and erosion could occur at the toe of the spillway in areas where the boulder riprap has been displaced.

7. The outlet facilities are inadequate to draw down the pond level, should the need occur.

8. Leakage through either the sluiceway channel wall or through the masonry spillway section could worsen and cause instability of these structures.

SECTION 4: OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

a. General - There are no formal operational procedures followed at the dam.

b. Description Of Any Formal Warning System In Effect -No formal warning system is in effect.

4.2 MAINTENANCE PROCEDURES

a. General - There is no formal program of maintenance or inspection at the dam.

b. Operating Facilities - No formal program for maintenance of operating facilities is in effect.

4.3 EVALUATION

Operation and maintenance procedures are non-existent. A formal program of operation and maintenance procedures should be implemented, including documentation to provide complete records for future reference. Also, a formal warning system should be developed and implemented within the time frame indicated in Section 7.1c. Remedial operation and maintenance recommendations are presented in Section 7.3.

SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The Versailles Pond Dam watershed is 43.6 square miles of flat to rolling, wooded terrain including several large swamps. The upstream impoundments listed in Section 1.3.a have a negligible to no effect in the reduction of peak inflows.

The dam is an earth embankment with a masonry spillway. It is basically a low surcharge storage - high spillage type project. The reservoir area of 59.7 acres is small in relation to the drainage area and, consequently, the surcharge storage of the project is too small to have any appreciable effect in the reduction of peak inflows.

5.2 DESIGN DATA

No computations could be found for the original design of the dam.

5.3 EXPERIENCE DATA

The maximum recorded discharge at the site is 2,800 cfs which occurred on September 21, 1938 (See page B-2).

5.4 VISUAL OBSERVATIONS

The top of the dam embankment varies in elevation from 88.5 at the spillway training wall to 88.7 for most of its length.

5.5 TEST FLOOD ANALYSIS

Based upon the U.S. Army Corps of Engineers "Preliminary Guidance for Estimating Maximum Probable Discharges" dated March, 1978; the watershed classification (flat) and the watershed area of 43.6 square miles, a PMF of 24,000 cfs or 550 cfs per square mile is estimated at the damsite. In accordance with the size (intermediate) and hazard (significant) classification, the range of test floods to be considered is from the ½ PMF to the PMF. Based on the degree of hazard associated with a breach of the dam, the test flood for Versailles Pond Dam is equivalent to the ½ PMF. The pond level at the start of the test flood is considered to be at elevation 80.5, 0.5 foot above the spillway crest. The peak outflow for the test flood is estimated at 12,000 cfs and this flow will be accomodated by the spillway with 0.6 foot of freeboard to the top of the dam. Based on hydraulics computations, the spillway capacity to the top of the dam is 13,000 cfs which is equivalent to 108% of the routed test flood outflow (Appendix D-6).

5.6 DAM FAILURE ANALYSIS

The dam failure analysis is based on the April, 1978 Army Corps of Engineers "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs". With the pond level at the top of the dam, peak outflow before failure of the dam would be about 13,000 cfs and the peak failure outflow from the dam breaching would total about 39,000 cfs. A breach of the dam would result in a rise in the water level of the stream at the initial impact area, from a depth of 6 feet just before the breach to a depth of about 11 feet shortly after the breach. This rapid, 5 foot increase in water level will flood 4 houses with less than 2 feet of water causing substantial economic loss while posing little threat to loss of life (Appendix D-8).

SECTION 6: EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS

The visual inspection did not reveal any indication of stability problems. There are minor areas of erosion, seepage, and deterioration as described in Section 3; however they are not considered to be stability concerns at the present time.

6.2 DESIGN AND CONSTRUCTION DATA

No information was available.

6.3 POST-CONSTRUCTION CHANGES

No post-construction changes to the project are known.

6.4 SEISMIC STABILITY

The project is in Seismic Zone 1 and, according to Army Corps of Engineers Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 PROJECT ASSESSMENT

a. Condition - Based upon the visual inspection of the site and past performance, the project appears to be in poor condition. No evidence of immediate structural instability was observed in the embankment or spillway; however there are areas which require repair and maintenance.

Based upon "Preliminary Guidance for Estimating Maximum Probable Discharges" dated March 1978, the watershed area and classification, and hydraulic/hydrologic computations, the peak inflow to the pond at test flood is 12,000 cfs; peak outflow is 12,000 cfs with the dam maintaining 0.6 foot of freeboard. Based upon our hydraulics computations, the spillway capacity to the top of the dam is 13,000 cfs, which is equivalent to approximately 108% of the routed test flood outflow.

b. Adequacy of Information - The information available is such that an assessment of the condition and stability of the project must be based solely on visual inspection, past performance and sound engineering judgement.

c. Urgency - It is recommended that the measures presented in Section 7.2 and 7.3 be implemented within one year of the owner's receipt of this report.

7.2 RECOMMENDATIONS

It is recommended that further studies be made by a registered professional engineer qualified in dam design and inspection pertaining to the following items. Recommendations made by the engineer should be implemented by the owner.

1. Rennovation or replacement of the wood bulkhead, gates, gate hoists, and service bridge.

2. Construction of a low-level outlet which would allow a full drawdown of the pond.

3. Removal of all trees and brush from the embankment and from within 25 feet of the toe. This should include removal of root systems, proper backfilling and regrading of the embankment.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures - The following measures should be undertaken by the owner within the length of time indicated in Section 7.1.c, and continued on a regular basis.

1. Round-the-clock surveillance should be provided during periods of heavy precipitation or high project discharge. A formal downstream warning system should be developed, to be used in case of emergencies at the dam.

2. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.

3. A comprehensive program of inspection by a registered professional engineer qualified in dam inspection should be instituted on an annual basis.

4. After the trees have been removed and the embankment regraded, riprap should be placed on the upstream slope from several feet below the normal pond level to the top of the dam and grassy vegetation should be established on the rest of the embankment.

5. The remaining stoplogs on the spillway crest should be removed to prevent sediment build-up and vegetation in the spillway approach channel.

6. Saplings growing from the downstream masonry face of the spillway, from the masonry sluiceway walls, or from any other masonry sections of the project should be removed to prevent displacement of masonry blocks. This practice and the practice of cutting saplings and brush from the embankment should be continued as part of the routine maintenance procedures at the dam.

7. Boulder riprap should be replaced in areas where it is missing at the toe of the spillway.

7.4 ALTERNATIVES

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Versailles Pond Dam DATE: June 2, 1980

TIME: 11am

WEATHER: Overcast 65°

W.S. ELEV. ____ U.S. ____ DN.S

PARTY:	INITIALS:	DISCIPLINE:
1. Peter Heynen	PH	Geotechnical
2. Ted Stevens	TS	Geotechnical
3. Hector Moreno	HM	Hydraulics
4. Robert Jahn	RJ	Hydraulics
5. Robert Charette	RC	Chief Eng.-Federal
6. Tim Kavanaugh, Moshé Norman		Survey

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Dam Embankment	PH, TS, HM, RJ	
2.	Intake Channel	PH, TS, HM, RJ	
3.	Tailrace Channel	PH, TS, HM, RJ	
4.	Masonry Spillway	PH, TS, HM, RJ	
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

PERIODIC INSPECTION CHECK LIST

PROJECT Versailles Pond Dam DATE 6-2-80

PROJECT FEATURE Dam Embankment BY PH, TS, HM, RJ

AREA EVALUATED		CONDITION
DAM EMBANKMENT		
Crest Elevation		88.7 - 88.5
Current Pool Elevation		80.0
Maximum Impoundment to Date		Not known
Surface Cracks		None observed
Pavement Condition		N/A
Movement or Settlement of Crest		Erosion near spillway abut.
Lateral Movement		Too irregular to judge
Vertical Alignment		Poor - crest irregular
Horizontal Alignment		Too irregular to judge
Condition at Abutment and at Concrete Structures		Fair - overgrown
Indications of Movement of Structural Items on Slopes		N/A
Trespassing on Slopes		None apparent
Sloughing or Erosion of Slopes or Abutments		Possible sloughing - U/S slope
Rock Slope Protection-Riprap Failures		Riprap absent
Unusual Movement or Cracking at or Near Toes		None observed
Unusual Embankment or Downstream Seepage		
Piping or Boils		
Foundation Drainage Features		
Toe Drains		
Instrumentation System		N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Versailles Pond Dam DATE 6-8-00

PROJECT FEATURE Intake Channel BY PH, TS, HM, RJ

AREA EVALUATED		CONDITION
OUTLET WORKS-INTAKE CHANNEL AND INTAKE STRUCTURE		Masonry lined intake to old tailrace
a) Approach Channel		
Slope Conditions		±6' deep - could not see bottom
Bottom Conditions		
Rock Slides or Falls		None
Log Boom		None
Debris		Old cofferdam partially in place
Condition of ~~Concrete~~ Masonry Lining		Fair - some mortar washed out
Drains or Weep Holes		None observed
b) Intake Structure		Wooden bridge and bulkhead
Condition of ~~Concrete~~ Masonry		Fair - some seepage
Stop Logs and Slots		Very poor condition; inoperable gates, holes in bulkhead

PERIODIC INSPECTION CHECK LIST

PROJECT Versailles Pond Dam DATE 6-2-80

PROJECT FEATURE Entrance Channel BY PHT

AREA EVALUATED		CONDITION
OUTLET WORKS-TRANSITION AND CONDUIT		
General Condition of ~~Concrete~~ Masonry		Fair-Poor — Some seepage noted; Heavy vegetation on wall; Partially demolished buildings adjacent to and over channel; Some demolition debris in channel.
Rust or Staining on ~~Concrete~~ Masonry		
Spalling		
Erosion or Cavitation		
Cracking		
Alignment of Monoliths		
Alignment of Joints		
Numbering of Monoliths		

PERIODIC INSPECTION CHECK LIST

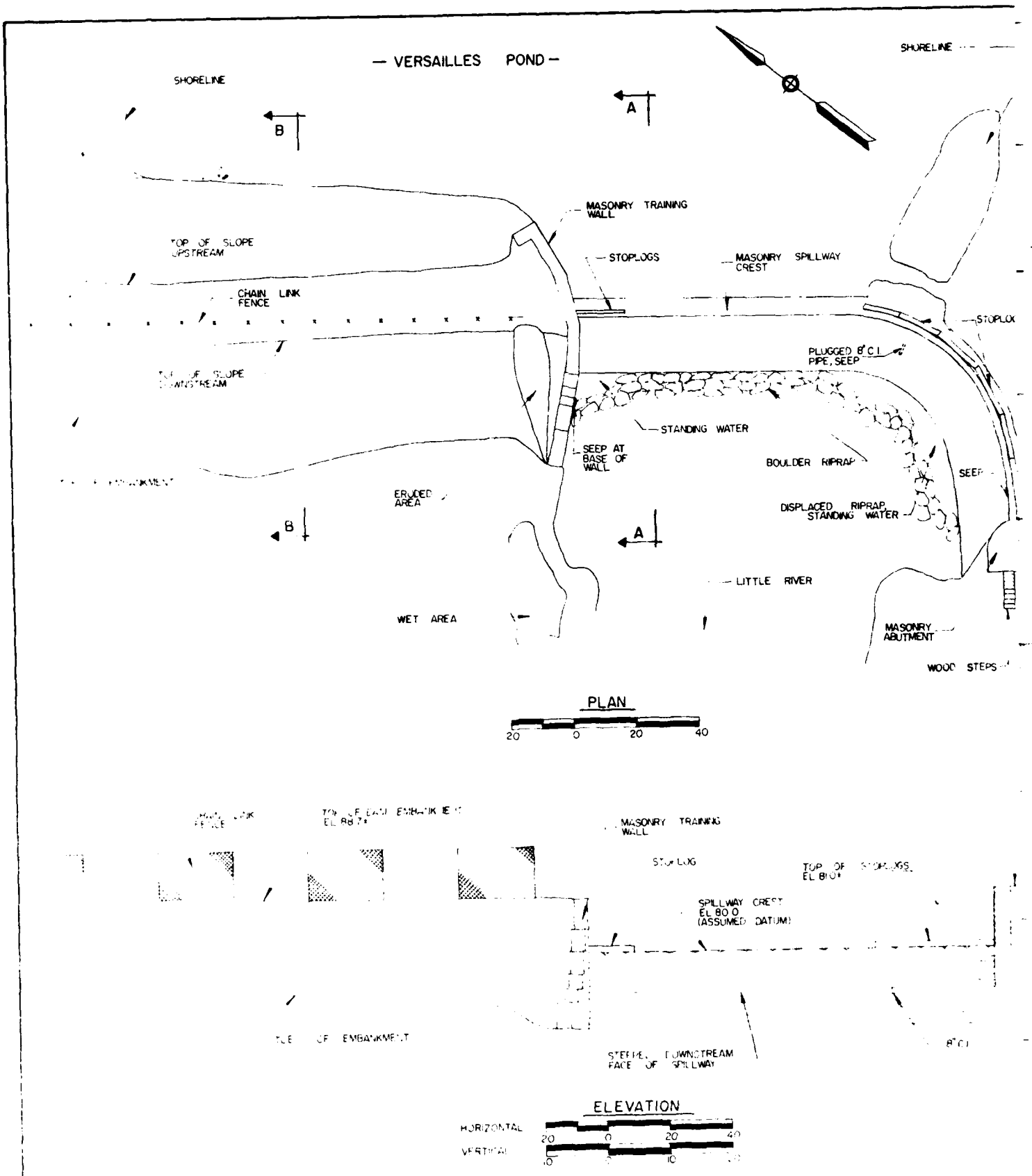
PROJECT Versailles Pond Dam DATE 6-2-80

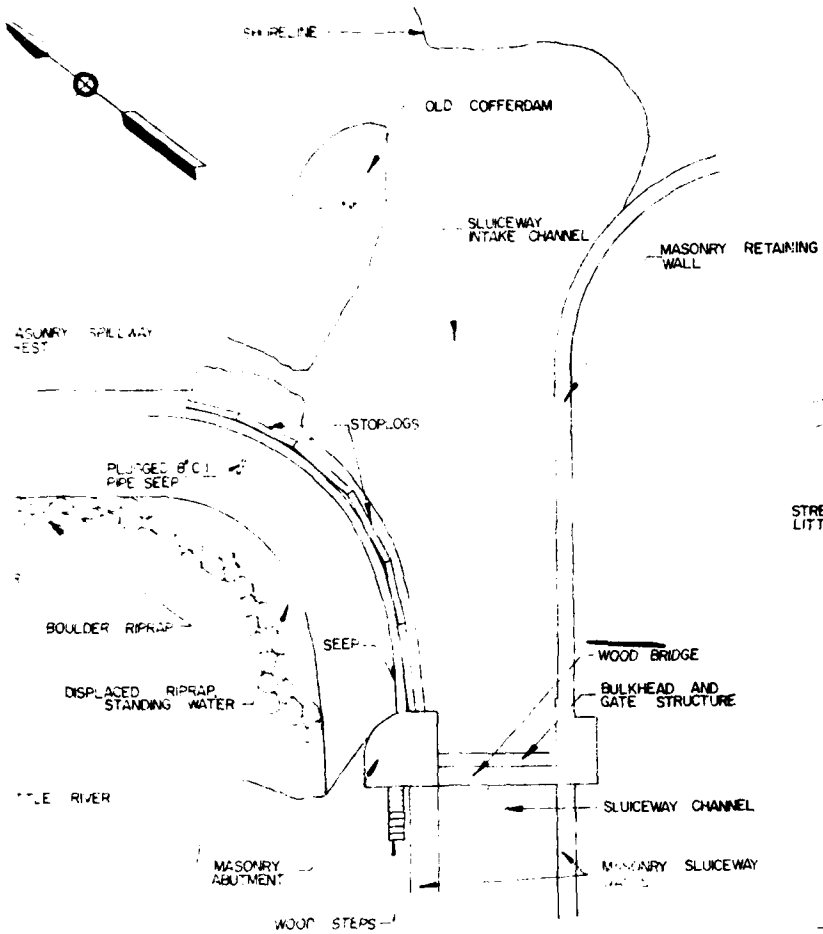
PROJECT FEATURE Main Spillway BY [illegible]

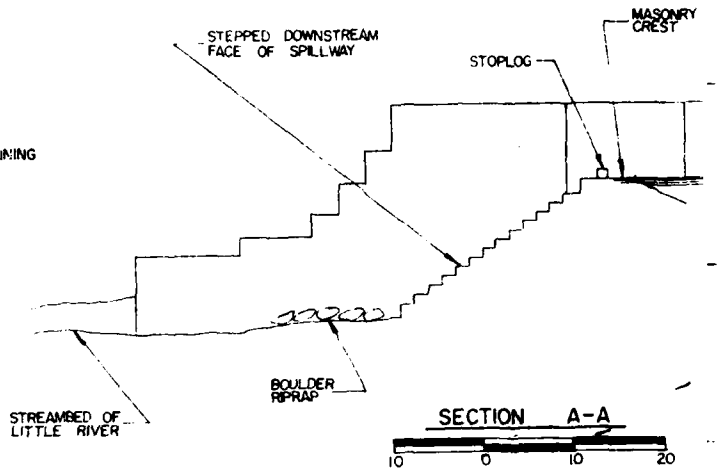
AREA EVALUATED	CONDITION
OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a) Approach Channel	
General Condition	Appears good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Yes-minor
Floor of Approach Channel	Silty, Sandy
b) Weir and Training Walls	
General Condition of ~~Concrete~~ Masonry	Good
Rust or Staining	None observed
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c) Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	No
Trees Overhanging Channel	Yes
Floor of Channel	Boulders
Other Obstructions	None observed

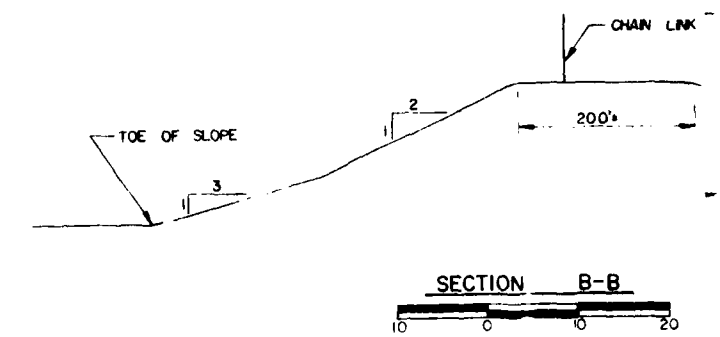
APPENDIX B

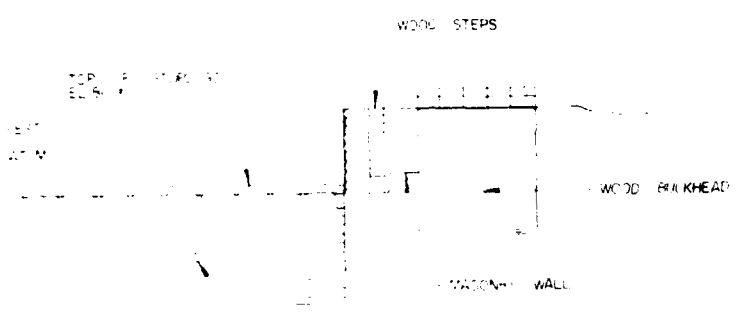
ENGINEERING DATA AND CORRESPONDENCE


— VERSAILLES POND —
SHORELINE
SHORELINE
A
B
MASONRY TRAINING WALL
TOP OF SLOPE UPSTREAM
STOPLOGS
MASONRY SPILLWAY CREST
CHAIN LINK FENCE
STOPLOG
PLUGGED 8" C.I. PIPE, SEEP
STANDING WATER
SEEP AT BASE OF WALL
BOULDER RIPRAP
SEEP
ERODED AREA
DISPLACED RIPRAP, STANDING WATER
B
A
LITTLE RIVER
WET AREA
MASONRY ABUTMENT
WOOD STEPS
PLAN
20 0 20 40
MASONRY TRAINING WALL
STOPLOG
SPILLWAY CREST EL 800 (ASSUMED DATUM)
STEPPED DOWNSTREAM FACE OF SPILLWAY
ELEVATION
HORIZONTAL
VERTICAL
20 0 20 40
10 0 10





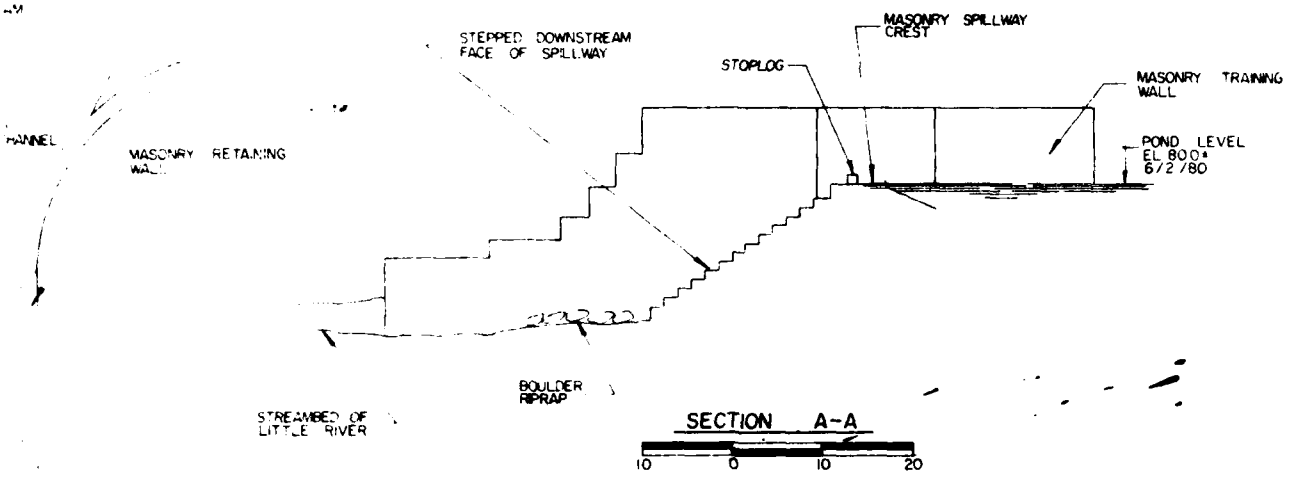




NOTES

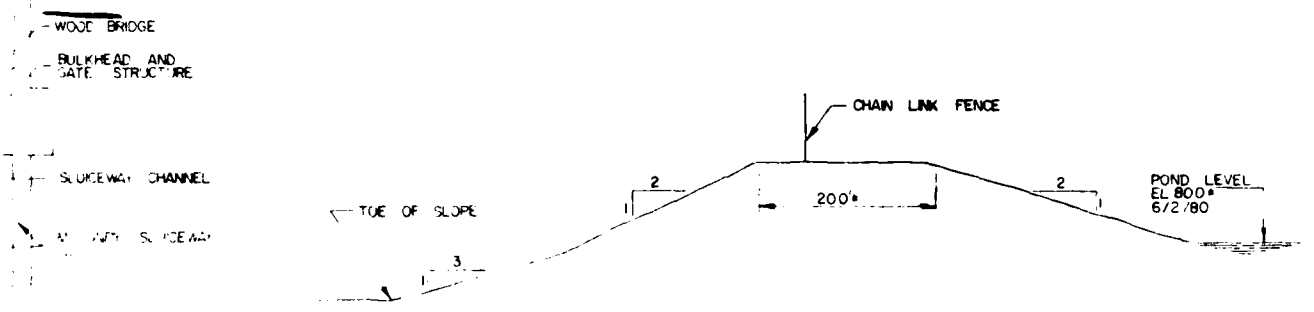
1. THIS PLAN WAS CO
   OF THE DAM DATED
   DIMENSIONS SHOWN
   AND/OR STRUCTURAL
2. NO ELEVATIONS WE
   THE WATER SURFAC
   SHOWN THE U.S.G.S.
   ASSUMED TO BE TH
   ALL OTHER ELEVAT
   ASSUMED SPILLWAY

CAHN ENGINEERS	
NATIONAL PROG	
PLA	
VERSAI	
LITTLE RIVER	
DRAWN BY	CHECKED



SECTION A-A

10 0 10 20



SECTION B-B

10 0 10 20

NOTES

1. THIS PLAN WAS COMPILED FROM CAHN ENGINEERS INSPECTION OF THE DAM DATED JUNE 2, 1980. DIMENSIONS SHOWN ARE APPROXIMATE NOT ALL TOPOGRAPHIC AND/OR STRUCTURAL FEATURES ARE NECESSARILY IDENTIFIED.
2. NO ELEVATIONS WERE AVAILABLE FOR THE DAM, THEREFORE THE WATER SURFACE ELEVATION OF 800 FOR THE POND SHOWN THE USGS NORWICH QUADRANGLE MAP WAS ASSUMED TO BE THE NGVD ELEVATION OF THE SPILLWAY CREST ALL OTHER ELEVATIONS SHOWN ARE REFERENCED TO THE ASSUMED SPILLWAY CREST ELEVATION.

CAHN ENGINEERS INC WALLINGFORD, CONNECTICUT ENGINEER	U S ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

PLAN, ELEVATION & SECTIONS

VERSAILLES POND DAM

LITTLE RIVER SPRAGUE, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED
[illegible]	[illegible]	[illegible]	DATE JULY 1980 SHEET 8

3

No. 4

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

4

CT-472

Inventoried By ______

Date ______

CLASS 3

Name of Dam or Pond [illegible] 15' head

Code No. S 29 LT 0.5 vol. ≥ 10 ac-ft

Nearest Street Location ______

Town ______ Long 72-27

U.S.G.S. Quad. [illegible]

Lat 41-36.1

Name of Stream [illegible]

Owner Federal Paper Board

Address [illegible]

[illegible] Sprague CT 822-8201

ok 12/78

Pond Used For [illegible]

Dimensions of Pond: Width ______ Length ______ Area [illegible]

Total Length of Dam ______ Length of Spillway [illegible]

Location of Spillway [illegible]

Height of Pond Above Stream Bed ______

Height of Embankment Above Spillway ______

Type of Spillway Construction ______

Type of Dike Construction ______

Downstream Conditions ______

______

Summary of File Data ______

______

Remarks ______

______

______

______

Would Failure Cause Damage? ______ Class ______

Excerpt from report on Hanover Reservoir Dam, by Macchi Engineers, dated Oct. 2[illegible], 1974.

HYDRAULIC CONSIDERATIONS

The total drainage area for this structure is 32.1 sq. mi. Within this area there are large storage (swamp) areas. The contributing area is a long narrow valley. Fourteen miles upstream of the Hanover Reservoir is located the Hampton Reservoir on the same valley. There is a gaging station in Little River which was established in 1951, located only 1.7 miles north of the Hanover Reservoir. The following information was obtained from the U.S. Geological Survey Office with regard to this gaging station:

Drainage area 29.1 sq. mi.

Long Term Mean Annual Flood 700 c.f.s.

Max. Recorded Flood (August 19, 1955) 1,400 c.f.s.

The U.S. Geological Service has also records at the Versailles Pond Dam located 4.2 miles downstream of the Hanover Reservoir, on the same valley. The following information was obtained from these records:

Drainage area 41.3 sq. mi.

Mean Annual Flood: 1,000 c.f.s.

Max. Recorded Flood (Sept. 21, 1938) 2,800 c.f.s.

Our hydraulic computations for the Hanover Reservoir give the following information:

Drainage area 32.1 sq. mi.

Mean Annual Flood 900 c.f.s.

100 Year Flood Frequency (5 MAF) - 4,500 c.f.s.

Spillway Capacity $Q = CxLxH^{3/2}$

$Q = 3 \times 136 \times 7^{3/2} = 7,550$ c.f.s.

Water depth of spillway to pass the estimated 100 year flood frequency = 5 ft. approx.

APPENDIX C

DETAIL PHOTOGRAPHS

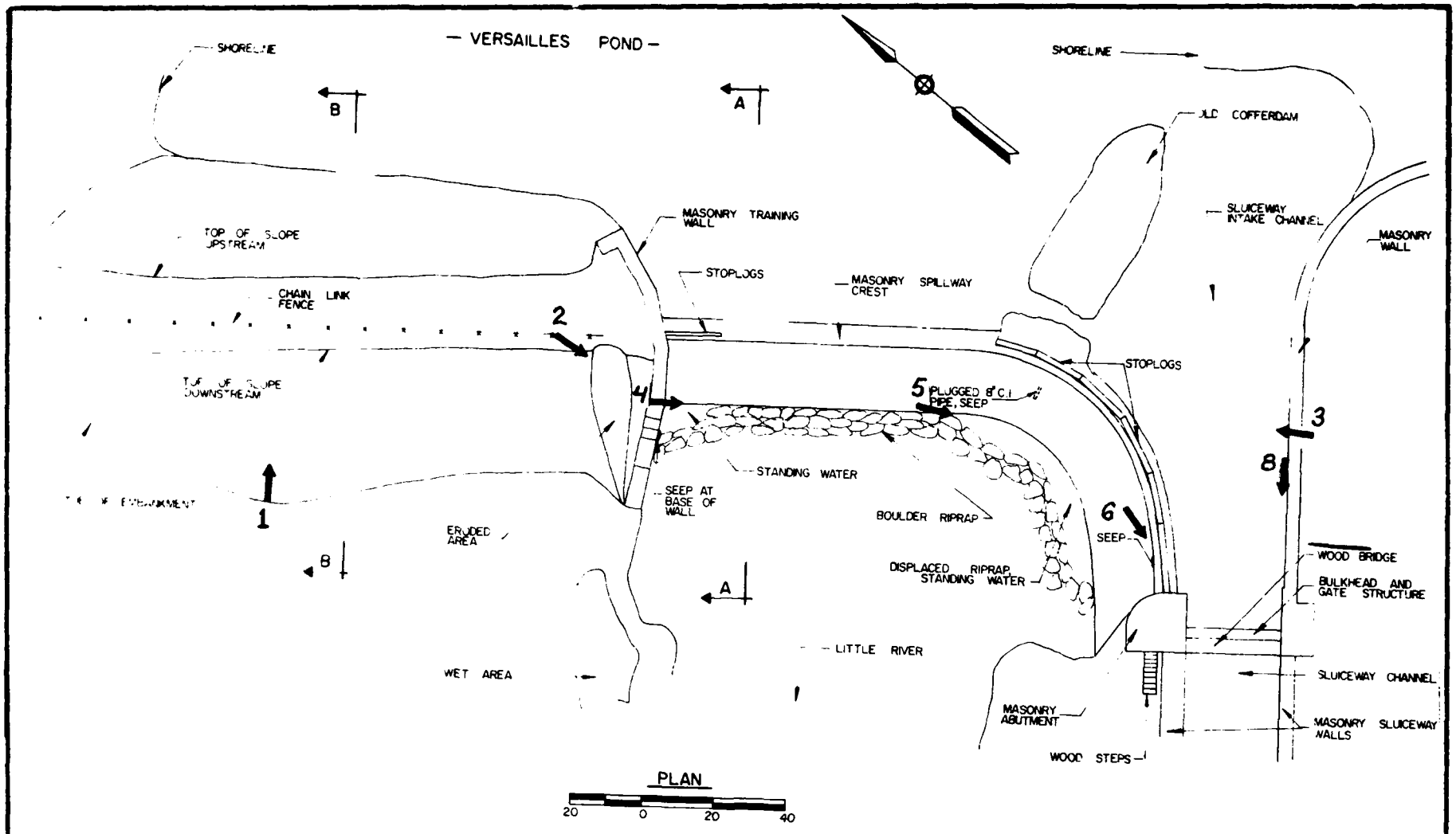


PHOTO LOCATION PLAN

VERSAILLES POND DAM

SHEET C-1

Photo 1 - Tree with six foot wide base located on downstream slope of embankment (6/2/80).

Photo 2 - Eroded area on downstream slope of embankment. Fully extended six foot ruler is being held parallel to the axis of the embankment (6/2/80).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	Versailles Pond Dam Little River Sprague, Conn.
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	INSPECTION OF NON-FED. DAMS	CE #27 785 KB DATE July, '80 PAGE C-1

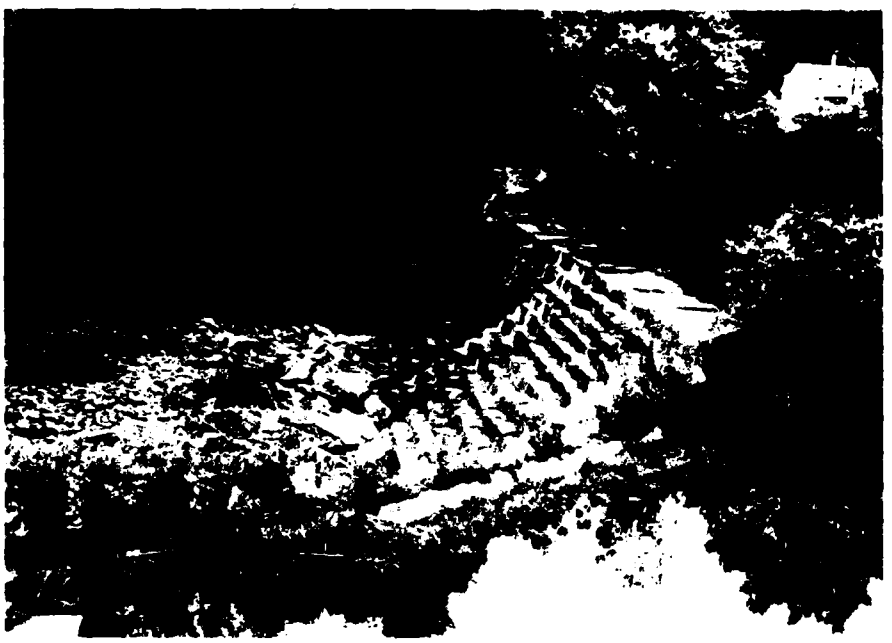


Photo 3 - View of spillway from left end. Note sedimentation and vegetation on upstream side of flashboards in foreground and in background at right end of spillway (6/2/80).

Photo 4 - View of spillway from right end. Note riprap displacement at toe and vegetation growth on downstream face (6/2/80).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF	Versailles Pond Dam Little River Sprague, Conn.
CAHN ENGINEERS INC. WALLINGFORD, CONN ENGINEER	INSPECTION OF NON-FED. DAMS	CE #27 785 KB DATE July, '80 PAGE C-2

Photo 5 - Closeup of riprap displacement at toe of spillway (6/2/80).

Photo 6 - Seepage through upper course of masonry near left end of spillway (6/2/80).

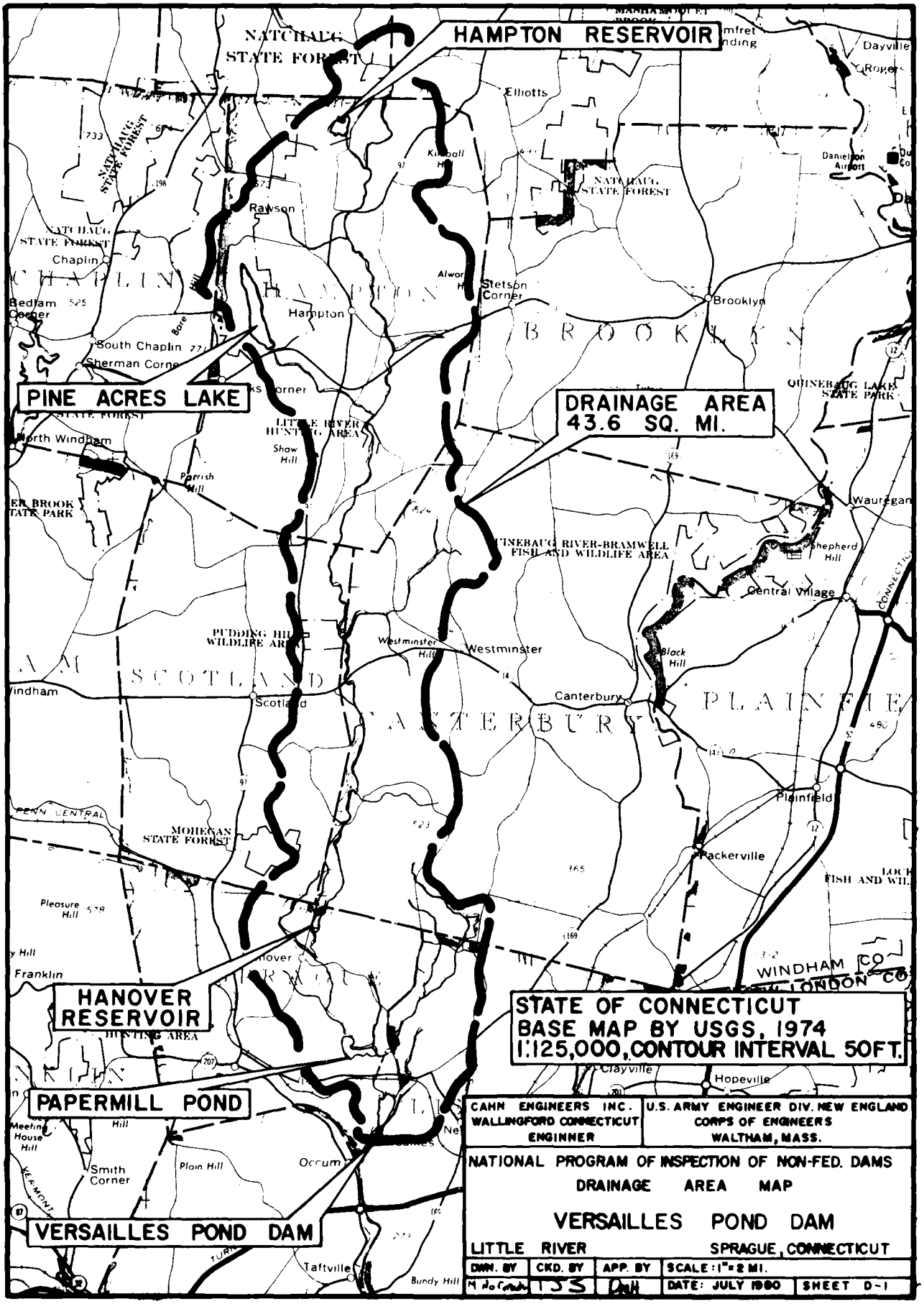
Photo 7 - Aerial view of spillway and sluiceway. Note breached cofferdam and partially demolished factory buildings (Feb. 1980).

Photo 8 - View from upstream of sluiceway bulkhead (6/2/80).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	Versailles Pond Dam Little River
CAHN ENGINEERS INC. WALLINGFORD, CONN ENGINEER	INSPECTION OF NON-FED. DAMS	Sprague, Conn. CE#27 785 KB DATE July, '80 PAGE C-4

APPENDIX D

HYDRAULICS/HYDROLOGIC COMPUTATIONS



CAHN ENGINEERS INC. WALLINGFORD CONNECTICUT ENGINNER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

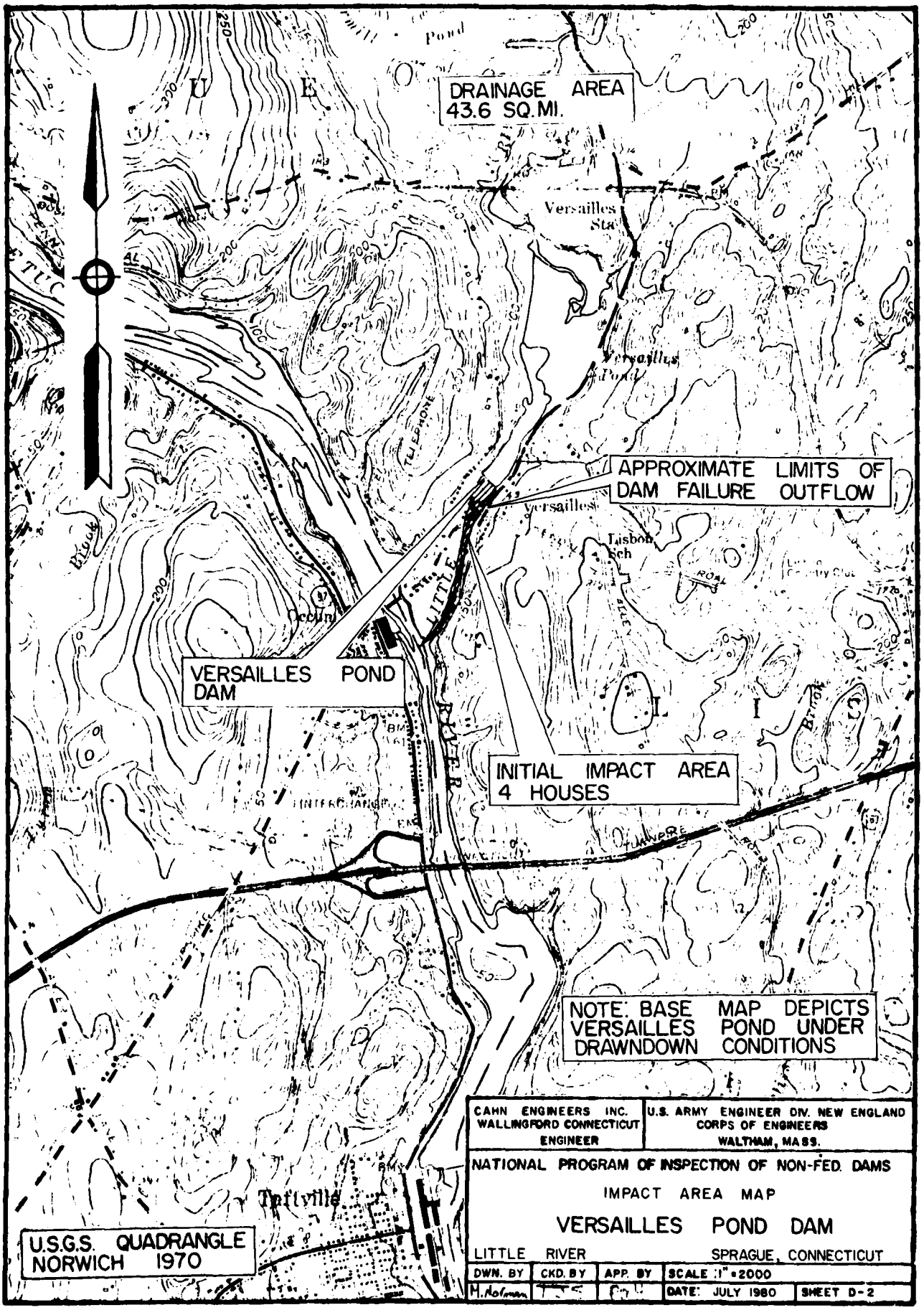
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DRAINAGE AREA MAP

VERSAILLES POND DAM

LITTLE RIVER SPRAGUE, CONNECTICUT

DWN. BY	CKD. BY	APP. BY	SCALE: 1"=2 MI.	
M do Canto	TSS	DHH	DATE: JULY 1980	SHEET D-1



CAHN ENGINEERS INC. WALLINGFORD CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

IMPACT AREA MAP

VERSAILLES POND DAM

LITTLE RIVER SPRAGUE, CONNECTICUT

DWN. BY	CKD. BY	APP. BY	SCALE :1" = 2000	
H. Adams			DATE: JULY 1980	SHEET D-2

HYDROLOGIC/HYDRAULIC INSPECTION

VERSAILLES POND DAM, SPRAGUE, CT.

I) PERFORMANCE AT PEAK FLOOD CONDITIONS:

1) PROBABLE MAXIMUM FLOOD (PMF)

a) WATERSHED CLASSIFIED AS "FLAT" BECAUSE OF THE LARGE VALLEY STORAGE CAPACITY OF THE WATERSHED AND REGULATION BY 4 RESERVOIRS.

b) WATERSHED AREA: DA = 43.6 SQ. MI

NOTE: D.A. FROM CONN. DEP BULLETIN N°1, 1972 (GAZETTEER OF NATURAL DRAINAGE AREAS) p. 11.

c) PEAK FLOODS (FROM NED-ACE GUIDELINES - GUIDE CURVES FOR PMF)

i) FROM GUIDE CURVES: CSM = 550 CFS/SQ MI

ii) PMF = 550 × 43.6 = 24000 CFS

iii) ½ PMF = 12000 CFS

2) SURCHARGE AT PEAK INFLOWS (PMF AND ½ PMF)

a) OUTFLOW RATING CURVE:

i) SPILLWAY AND OVERFLOW PROFILE FOR SURCHARGES OVERTOPPING THE DAM:

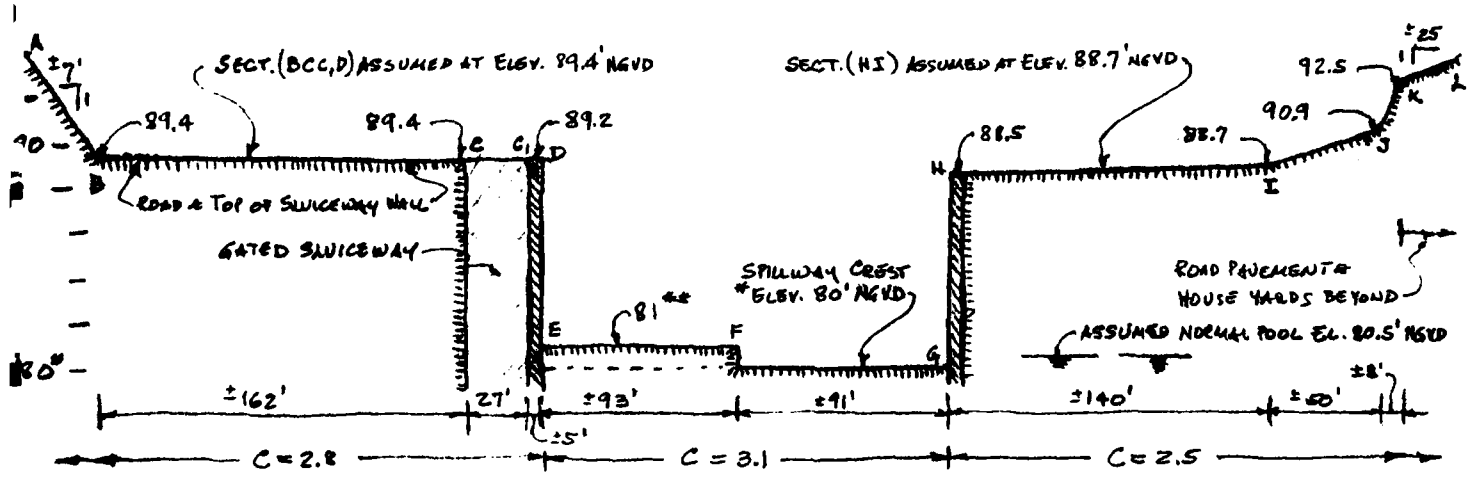
SPILLWAY (±) 184' LONG ((±) 73' CURVED SECTION WITH 1' HIGH STOPLOGS AS CREST), STONE MASONRY BROAD CRESTED (±6' WIDE), VERTICAL (STEPPED) D/S FACE AND SLOPING U/S FACE.
THE EARTH EMBANKMENT TO THE RIGHT AND EXTENDING TO THE STREET ON THAT SIDE IS WOODED AND HAS A (±) 3' HIGH CHAIN LINK FENCE RUNNING ITS ENTIRE LENGTH. ACROSS THE STREET PAVEMENT, THE OVERFLOW SECTION CONTINUES THROUGH THE YARDS OF THE HOMES WHICH FACE THE STREET TO THE LEFT,

Cahn Engineers Inc. — Consulting Engineers

Project: NON-FEDERAL DAMS INSPECTION — Sheet D-2 of 10
Computed By: [illegible] — Checked By: GAB — Date: 5/6/80
Field Book Ref. — Other Refs.: CE #27-785-HA — Revisions

THE OVERFLOW SECTION EXTENDS FROM THE STONE WALL / ABUTMENT OF THE SPILLWAY ACROSS THE SLUICEWAY INTAKE WORKS TO THE SLUICEWAY LEFT SIDE WALL AND BEYOND, TO THE ROAD AND GRASSED LAND AT THIS SIDE OF THE DAM. EXCEPT FOR SOME FENCED SECTIONS THE LEFT SIDE OVERFLOW IS CLEAR FROM MAJOR OBSTRUCTIONS.

THEREFORE ASSUME C = 3.1 FOR THE SPILLWAY FLOW (WITH OR W/O STOP LOGS); C = 2.8 FOR THE LEFT SIDE AND C = 2.5 FOR THE RIGHT SIDE OVERFLOWS. (SEE PROFILE)



** THE SPILLWAY SECTION (EF) HAS ±1' HIGH BOLTED STOP LOGS W/CONCRETE BACKING (TOTAL WIDTH = 18") ABOVE THE SPILLWAY CREST SLABS. A SHORT DISTANCE (NEGLIGEABLE) OF THE RIGHT END OF THE SPILLWAY ALSO HAS STOP LOGS.

DATA FROM CE OBSERVATIONS ON 5/2/80 BY [illegible] & RJ.

VERSAILLES POND DAM
APPROXIMATE OVERFLOW PROFILE

*NOTE. W.S. ELEV. 80', MSL ON THE USGS NORWICH, CT. QUADRANGLE SHEET (1954) IS ASSUMED TO BE SPILLWAY CREST ELEVATION ON NATIONAL GEODETIC VERTICAL DATUM (NGVD).

ii) THEREFORE, ASSUMING EQUIVALENT LENGTHS FOR THE SLOPING TERRAIN, THE DISCHARGE RATING CURVE FOR THE DISCHARGE (H) ABOVE THE SPILLWAY CREST CAN BE APPROXIMATED AS FOLLOWS (SEE PROFILE, P. D-2):

1') SECTION AB: $Q_{AB} = \frac{2}{3} \times 7 \times 2.8 (H-9.4)^{5/2} = \underline{13.1 (H-9.4)^{5/2}}$

2') SECTION BCC,D: $Q_{BCC,D} = 2.8 \times 194 (H-9.4)^{3/2} = \underline{543 (H-9.4)^{3/2}}$

3') SPILLWAY:

SECTION EF: $(Q_S)_1 = Q_{EF} = 3.1 \times 93 (H-1)^{3/2} = \underline{288 (H-1)^{3/2}}$

SECTION FG: $(Q_S)_2 = Q_{FG} = 3.1 \times 91 H^{3/2} = \underline{282 H^{3/2}}$

4') SECTION HI: $Q_{HI} = 2.5 \times 140 (H-8.7)^{3/2} = \underline{350 (H-8.7)^{3/2}}$

5') SECTION JJ:

$(Q_{JJ})_1 = \frac{2}{3} \times 50/2.2 \times 2.5 (H-8.7)^{5/2} = \underline{37.9 (H-8.7)^{5/2}}$ $H \leq 10.9$

$(Q_{JJ})_2 = 50 \times 2.5 (H-9.22)^{3/2} = \underline{125 (H-9.22)^{3/2}}$ $H > 10.9$

6') SECTION JK:

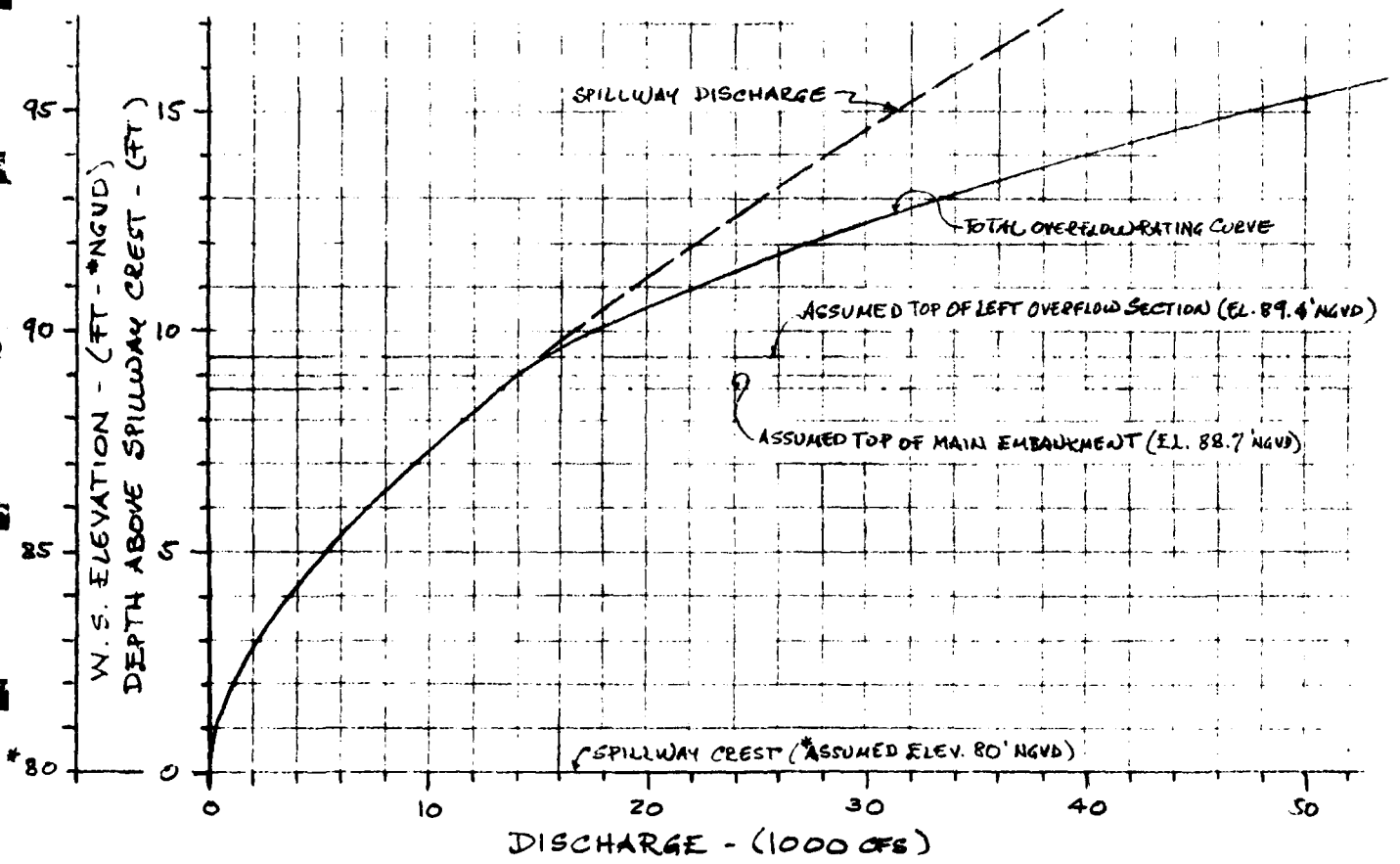
$(Q_{JK})_1 = \frac{2}{3} \times 8/1.6 \times 2.5 (H-10.9)^{5/2} = \underline{8.33 (H-10.9)^{5/2}}$ $H \leq 12.5$

$(Q_{JK})_2 = 8 \times 2.5 (H-11.3)^{3/2} = \underline{20 (H-11.3)^{3/2}}$ $H > 12.5$

7') SECTION KL: $Q_{KL} = \frac{2}{3} \times 25 \times 2.5 (H-12.5)^{5/2} = \underline{41.7 (H-12.5)^{5/2}}$

THEREFORE, THE TOTAL OUTFLOW IS APPROXIMATED BY THE SUM OF ALL THE APPLICABLE FORMULAE ON ITEMS (1') TO (7'), AND THE CORRESPONDING CURVE IS PLOTTED ON P. D-4.

iii) VERSAILLES POND DAM - OUTFLOW RATING CURVE



*SEE NOTE p. D-2

b) SURCHARGE HEIGHT TO PASS PEAK INFLOW - $(Q_p + Q_{p_1}')$

i) @ Q_p = PMF = 24000 CFS $H_1 = 11.4'$

ii) @ $Q_{p_1}' = \frac{1}{2}$ PMF = 12000 CFS $H_1 = 8.1'$

C) EFFECT OF SURCHARGE STORAGE - PEAK OUTFLOWS:

i) AVE. LAKE AREA ($\bar{A}$) WITHIN EXPECTED SURCHARGE:

1') LAKE AREA AT FLOW LINE (EL. 80' NGVD)*: $A_{80L} = 59.7^{ac}$
2') AREA AT CONTOUR 90' NGVD (MSL)*: $A_{90} = 97.3^{ac}$
3') AREA AT CONTOUR 100' NGVD (MSL)*: $A_{100} = 138^{ac}$

∴ AVE. AREA WITHIN MAX. EXPECTED SURCHARGE (±15.5'): $\bar{A} \simeq 81.4^{ac}$
(LINEAR INTERPOLATION: (3) $A_{95.8}$ - SEE CURVE P.D.-6)

*NOTE: AREAS FROM USGS, NORWICH, CT. QUAD SHEET (1954) - SCALE 1"=2000'
REV. QUAD SHEET (1970) SHOWS LAKE DRAINED W/ A SURFACE AREA OF $A = 14.2^{ac}$

ii) ASSUME NORMAL POOL AT ELEV. 80.5' NGVD ($H = 0.5'$)

iii) WATERSHED D.A. $\simeq 43.6^{sq\ mi}$ (SEE P. D-1)

iv) PEAK OUTFLOWS (Q_{P_3} & Q'_{P_3})

BECAUSE THE LAKE AREA AND CONSEQUENTLY, THE SURCHARGE STORAGE OF VERSAILLES POND ARE TOO SMALL TO HAVE AN APPRECIABLE EFFECT IN THE REDUCTION OF THE PEAK INFLOW, THE PEAK OUTFLOWS ARE APPROXIMATELY,

$Q_{P_3} \simeq Q_{P_1} = 24000^{cfs}$ $\quad H_3 \simeq 11.4'$

$Q'_{P_3} \simeq Q'_{P_1} = 12000^{cfs}$ $\quad H'_3 \simeq 8.1'$

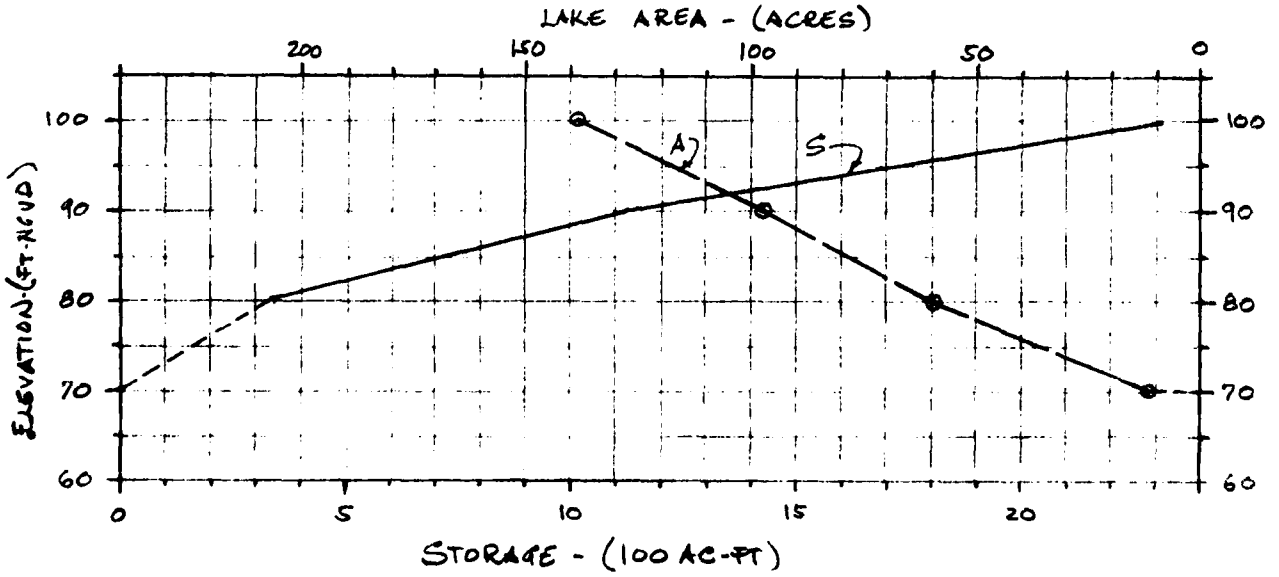
3) SPILLWAY CAPACITY RATIO TO PEAK INFLOW.

SPILLWAY CAPACITY TO:	SURCH.* H (FT)	W.S. ELEV. (FT-NGVD)	SPILLWAY CAPACITY (CFS)	SPILLWAY CAPACITY AS % OF PEAK OUTFLOWS	
				Q_{IP} (24000 CFS)	Q'_{IP} (12000 CFS)
TOP OF DAM**	8.7	88.7	13000	54	108
½ PMF	8.1	88.1	12000	—	100
PMF	11.4	91.4	20500	85	—

*SURCHARGE ABOVE SPILLWAY CREST

**ASSUMED TOP OF MAIN EMBANKMENT (RIGHT), ELEV. 88.7' NGVD.

4) RESERVOIR AREA/STORAGE CURVES - VERSAILLES POND



©AREAS MEASURED ON USGS, NORWICH, CT. QUADRANGLE SHEETS (1954 & 1970)
NOTE - SEE PP. D-5 (AREAS) AND D-8 (STORAGE)

VERSAILLES POND DAM

II) DOWNSTREAM FAILURE DATA:

1) POTENTIAL IMPACT AREA

FOUR HOUSES ON THE LEFT BANK OF LITTLE RIVER (+) 1000' ± FROM VERSAILLES POND DAM, WITH FIRST FLOOR ELEVATIONS BETWEEN (+)9' AND 11', CONSTITUTE THE POTENTIAL IMPACT AREA IN CASE OF FAILURE OF THIS DAM.

2) FAILURE AT VERSAILLES POND DAM

ASSUME DISCHARGE TO TOP OF DAM ELEV. 88.7' NGVD

a) HEIGHT OF DAM*: $H_d = 23'$

b) MID-HEIGHT LENGTH*: $L_d = 365'$

c) BREACH WIDTH (SEE NED-ACE 2/5 DAM FAILURE GUIDELINES):

$W = 0.4 \times 365 = 146'$; ASSUME $W_b = \underline{140'}$

d) ASSUMED WATER DEPTH AT TIME OF FAILURE: $Y_o = \underline{23'}$

e) [illegible] DISCHARGE AT TIME OF FAILURE: $Q_o = 1300$ CFS (SEE p. D-6)

f) BREACH OUTFLOW (SEE NED-ACE GUIDELINES):

$$Q_b = \frac{8}{27} W_b \sqrt{g} \left(\frac{Y_o}{10}\right)^{3/2} = 26000 \text{ CFS}$$

g) PEAK FAILURE OUTFLOW (Q_p) TO LITTLE RIVER.

[illegible] $Q_p = \underline{39000}$ CFS

*FROM C.E. FIELD MEASUREMENTS ON 5/2/80 BY HH & K.S.

3) FLOOD DEPTH * IMMEDIATELY D/S FROM DAM

$Y = 0.44 Y_0 = 10.1'$ SAY, $Y = \underline{10'}$

*(FROM THE RETREATING WAVE THEORY APPLIED TO DAM FAILURE)

4) ESTIMATE OF D/S FAILURE CONDITIONS AT POTENTIAL IMPACT AREA:

(SEE NED-ACE GUIDELINES FOR ESTIMATING D/S FAILURE HYDROGRAPHS)

a) THE (±)1000' LONG REACH OF LITTLE RIVER FROM THE DAM TO THE POTENTIAL IMPACT AREA IS GENERALLY TRAPEZOIDAL IN CROSS SECTION WITH (±)200' BASE AND (±) 6" AND 10" TO 1' SIDE SLOPES. THE AVERAGE REACH SLOPE IS (±) 1.1%.

b) RESERVOIR STORAGE AT TIME OF FAILURE:

*$S_{MAX} = \underline{1000}$ AC-FT

*C.E ESTIMATE BASED PRIMARILY ON LAKE AREA AT FLOWLINE AND DRAWDOWN CONDITIONS FROM USGS NORWICH QUAD. SHEETS (SEE P. D-5) AND AN ASSUMED DEPTH OF (±) 9': $S_{WL} = 37^{AC} \times 9 = 330^{AC-FT}$; ALSO, BY APPROX. FORMULA $S_{WL} = 0.42 \times A \times H = 0.42 \times 59.7 \times 14.2 = 360^{AC-FT}$ (TO FLOWLINE); FOR SURCH. STOR. $S_{SURCH} = 8.7 \times 76^{AC} = 660^{AC-FT}$ $\therefore S_{MAX} = 330 + 660 = 990$ SAY, $S_{MAX} = \underline{1000}$. (SEE CURVE P. D-6)

c) APPROXIMATE STAGE AT POTENTIAL IMPACT AREA AFTER FAILURE (NEGLECT CHANNEL STORAGE):

$Q_{P_1} = Q_{P_2} = \underline{39000}$ CFS $\therefore Y_3 = 10.7'$; SAY, $Y_3 = \underline{11'}$ ($n = 0.050$)

d) APPROXIMATE STAGE BEFORE FAILURE. $Q_S = \underline{13000}$ CFS $Y_S = 6.5'$ SAY, $Y_S = \underline{6'}$

e) RAISE IN STAGE AT IMPACT AREA: $\Delta Y = \underline{5'}$

III) SELECTION OF TEST FLOOD

1) CLASSIFICATION OF DAM ACCORDING TO NED-ACE GUIDELINES:

a) SIZE: *STORAGE (MAX) $\cong$ 1000 ACFT ($1000 \leq S < 50000$ ACFT)
*HEIGHT $\cong$ 23' ($H < 25$ FT)

*STORAGE: SEE p. D-8; HEIGHT: SEE p. D-7

∴ SIZE CLASSIFICATION: INTERMEDIATE

b) HAZARD POTENTIAL: AS A RESULT OF THE PA FAILURE ANALYSIS AND IN VIEW OF THE IMPACT THAT FAILURE OF VERSAILLES POND DAM MAY HAVE ON THE POTENTIAL IMPACT AREA (p. D-7), THE DAM IS CLASSIFIED AS HAVING:

HAZARD CLASSIFICATION: SIGNIFICANT

3) TEST FLOOD: ½ PMF = 12000 CFS

THIS SELECTION IS BASED ON THE RESULTS OF THE PREVIOUS ANALYSIS AND CLASSIFICATION.

VERSAILLES POND DAM

IV) SUMMARY

1) TEST FLOOD = ½ PMF ≅ 12000 CFS
(PARALLEL COMPUTATIONS HAVE BEEN MADE FOR PMF ≅ 24000 CFS AND ARE ALSO SUMMARIZED BELOW)

2) PERFORMANCE AT PEAK FLOOD CONDITIONS:
a) PEAK INFLOWS: Q_{I_1} = PMF ≅ 24000 CFS Q'_{I_1} = ½ PMF ≅ 12000 CFS
b) PEAK OUTFLOWS: $Q_{B_3} \cong Q_{P_1} \cong$ 24000 CFS $Q'_{B} \cong Q'_{P_1} \cong$ 12000 CFS
c) SPILLWAY CAPACITY: (SEE TABLE p. D-6)
d) PERFORMANCE:
i) AT TEST FLOOD: FREEBOARD (±) 0.6' (W.S. EL. 88.1' NGVD)
ii) AT PMF: OVERTOPPED (±) 2.7' (W.S. EL. 91.4' NGVD)

3) DOWNSTREAM FAILURE CONDITIONS:
a) PEAK FAILURE OUTFLOW: $Q_{P_1} \cong$ 39000 CFS
b) FLOOD DEPTH IMMEDIATELY ½ FROM DAM: $Y_0 \cong$ 10'
c) CONDITIONS AT THE INITIAL IMPACT AREA (LITTLE RIVER):
STAGE BEFORE FAILURE: $(Y_s) \cong$ 6' (Q_s = 13000 CFS)
STAGE AFTER FAILURE: $(Y_3) \cong$ 11' ($Q_{B_3} \cong Q_{P_1}$ = 39000 CFS)
RAISE IN STAGE AFTER FAILURE: $\Delta Y \cong$ 5'

PRELIMINARY GUIDANCE

FOR ESTIMATING

MAXIMUM PROBABLE DISCHARGES

IN

PHASE I DAM SAFETY

INVESTIGATIONS

New England Division
Corps of Engineers

March 1978

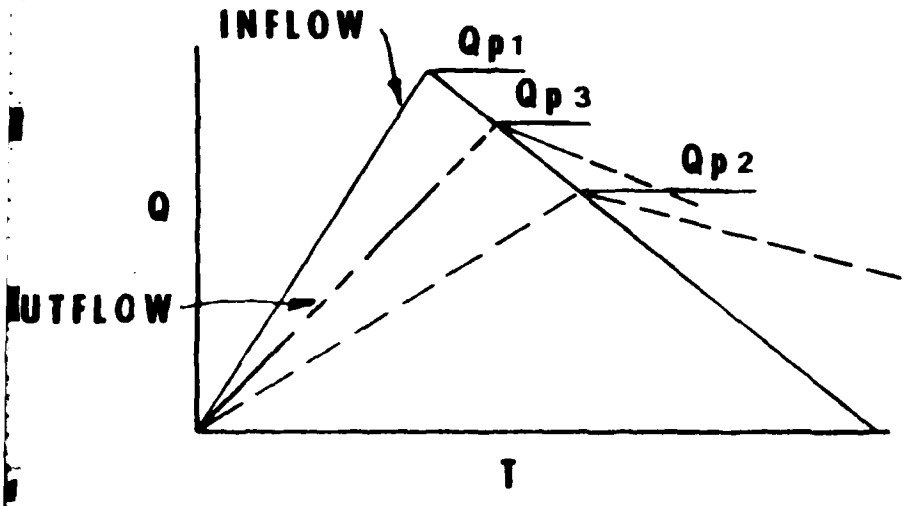
MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

	Project	Q (cfs)	D.A. (sq. mi.)	MPF cfs/sq. mi.
1.	Hall Meadow Brook	26,600	17.2	1,546
2.	East Branch	15,500	9.25	1,675
3.	Thomaston	158,000	97.2	1,625
4.	Northfield Brook	9,000	5.7	1,580
5.	Black Rock	35,000	20.4	1,715
6.	Hancock Brook	20,700	12.0	1,725
7.	Hop Brook	26,400	16.4	1,610
8.	Tully	47,000	50.0	940
9.	Barre Falls	61,000	55.0	1,109
10.	Conant Brook	11,900	7.8	1,525
11.	Knightville	160,000	162.0	987
12.	Littleville	98,000	52.3	1,870
13.	Colebrook River	165,000	118.0	1,400
14.	Mad River	30,000	18.2	1,650
15.	Sucker Brook	6,500	3.43	1,895
16.	Union Village	110,000	126.0	873
17.	North Hartland	199,000	220.0	904
18.	North Springfield	157,000	158.0	994
19.	Ball Mountain	190,000	172.0	1,105
20.	Townshend	228,000	106.0(278 total)	820
21.	Surry Mountain	63,000	100.0	630
22.	Otter Brook	45,000	47.0	957
23.	Birch Hill	88,500	175.0	505
24.	East Brimfield	73,900	67.5	1,095
25.	Westville	38,400	99.5(32 net)	1,200
26.	West Thompson	85,000	173.5(74 net)	1,150
27.	Hodges Village	35,600	31.1	1,145
28.	Buffumville	36,500	26.5	1,377
29.	Mansfield Hollow	125,000	159.0	786
30.	West Hill	26,000	28.0	928
31.	Franklin Falls	210,000	1000.0	210
32.	Blackwater	66,500	128.0	520
33.	Hopkinton	135,000	426.0	316
34.	Everett	68,000	64.0	1,062
35.	MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS
BASED ON TWICE THE
STANDARD PROJECT FLOOD
(Flat and Coastal Areas)

River	SPF (cfs)	D.A. (sq. mi.)	MPF (cfs/sq. mi.)
1. Pawtuxet River	19,000	200	190
2. Mill River (R.I.)	8,500	34	500
3. Peters River (R.I.)	3,200	13	490
4. Kettle Brook	8,000	30	530
5. Sudbury River.	11,700	86	270
6. Indian Brook (Hopk.)	1,000	5.9	340
7. Charles River.	6,000	184	65
8. Blackstone River.	43,000	416	200
9. Quinebaug River	55,000	331	330

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Qp_1) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Qp_1".

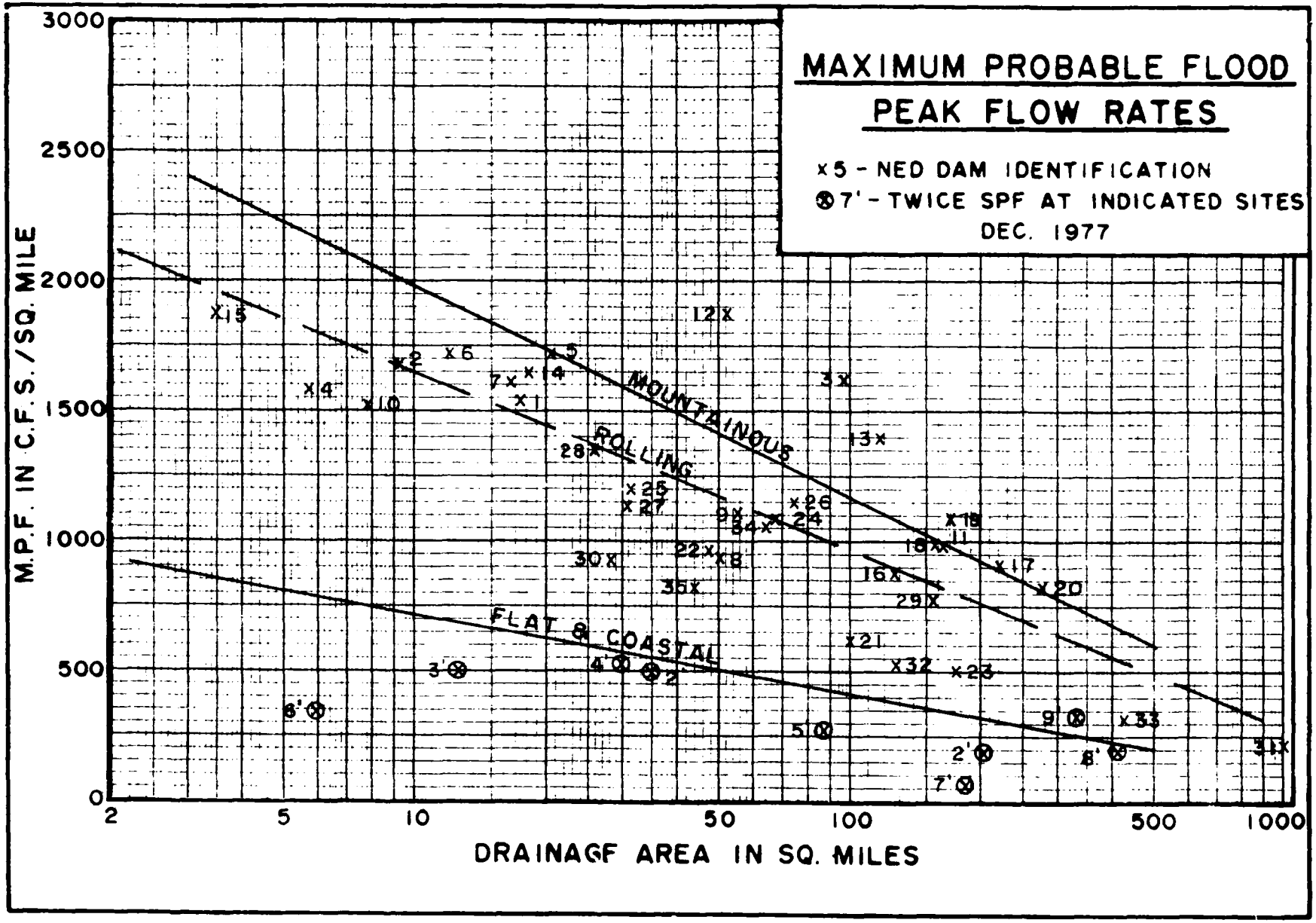
b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore:

$$Qp_2 = Qp_1 \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Average "$STOR_1$" and "$STOR_2$" and Determine Average Surcharge and Resulting Peak Outflow "Qp_3".


MAXIMUM PROBABLE FLOOD
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
⊗7' - TWICE SPF AT INDICATED SITES
DEC. 1977
M.P.F. IN C.F.S./SQ. MILE
DRAINAGE AREA IN SQ. MILES
3000
2500
2000
1500
1000
500
0
2
5
10
50
100
500
1000
MOUNTAINOUS
ROLLING
FLAT & COASTAL
x15
x4
x10
x2
x6
x5
7x
x14
x1
12x
3x
13x
28x
x25
x27
x26
9x
84x
x24
x18
11
18x
x17
x20
16x
29x
30x
22x
x8
35x
x21
x32
x23
3⊗
4⊗
2
6'⊗
5⊗
9⊗
x33
2'⊗
8'⊗
7'⊗
31x

SURCHARGE STORAGE ROUTING SUPPLEMENT

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Avg "$STOR_1$" and "$STOR_2$" and Compute "Qp_3".

c. If Surcharge Height for Qp_3 and "$STOR_{AVG}$" agree O.K. If Not:

STEP 4: a. Determine Surcharge Height and "$STOR_3$" To Pass "Qp_3"

b. Avg. "Old $STOR_{AVG}$" and "$STOR_3$" and Compute "Qp_4"

c. Surcharge Height for Qp_4 and "New $STOR_{Avg}$" should Agree closely

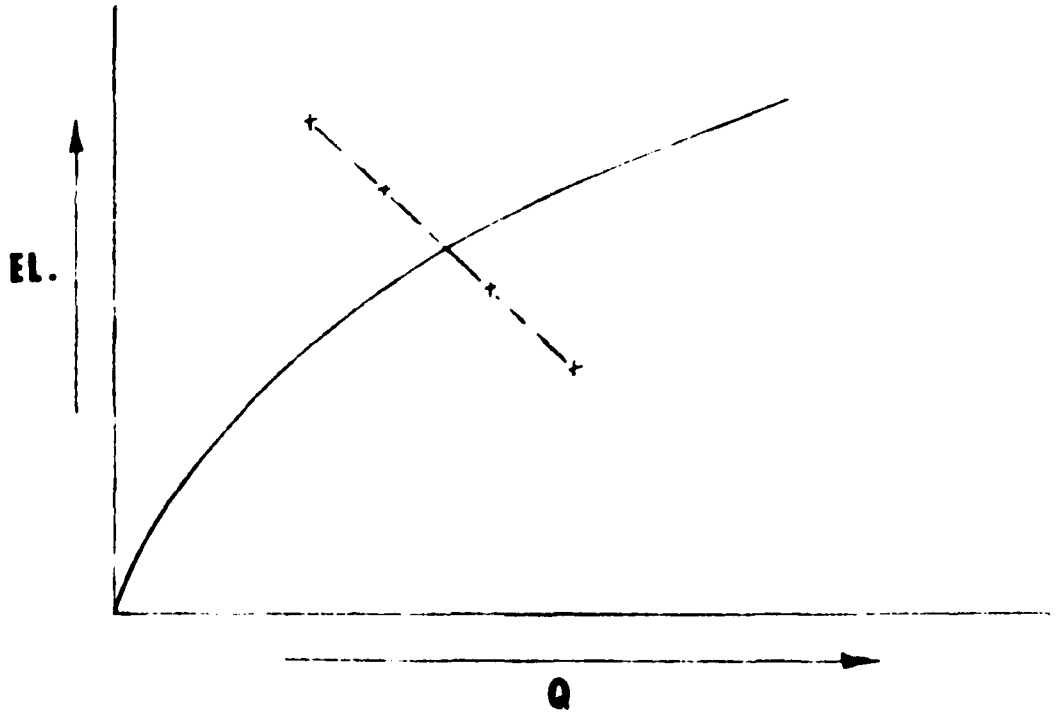
SURCHARGE STORAGE ROUTING ALTERNATE

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR}{19}\right)$$

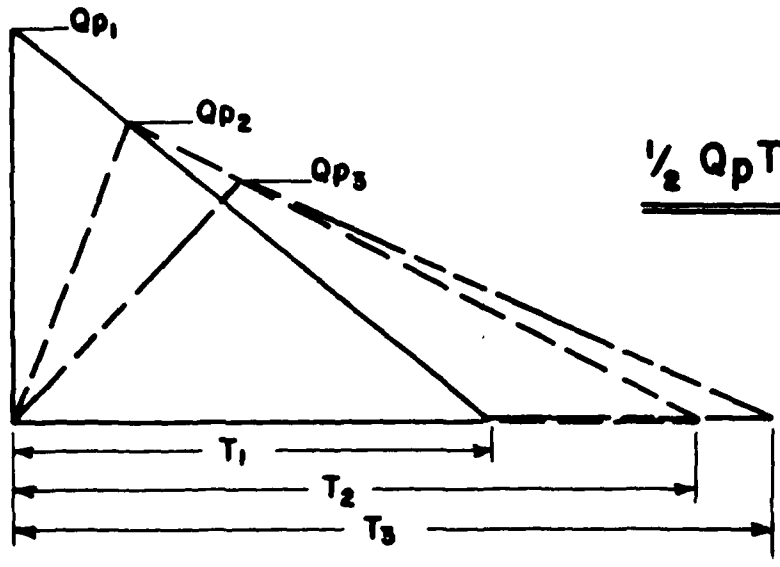
$$Q_{p2} = Q_{p1} - Q_{p1}\left(\frac{STOR}{19}\right)$$

FOR KNOWN Q_{p1} AND 19'' R.O.

Q_{p2}	STOR	EL.
≡≡≡	≡≡≡	≡≡≡



"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



$\frac{1}{2} Q_p T = 12 S$

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Qp_1 = \frac{8}{27} W_b \sqrt{g} Y_o^{\frac{3}{2}}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_o = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOPMANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Qp_2(\text{TRIAL}) = Qp_1 \left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

$$Qp_2 = Qp_1 \left(1 - \frac{V_{ave}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY | MO | YR
CT	472	NED	CT	011	02				VERSAILLES POND	4136.1	7202.7	18SEP80

POPULAR NAME	NAME OF IMPOUNDMENT
	VERSAILLES POND

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	10	LITTLE RIVER	VERSAILLES	1	350

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REGTPG	1920	R	23	23	1000	340	NED	N	N	N	N	

REMARKS
21=MASONRY

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	400		184	13000												

OWNER	ENGINEERING BY	CONSTRUCTION BY
FEDERAL PAPERBOARD CO	UNKNOWN	UNKNOWN

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	CT DEP	CT DEP

INSPECTION BY	INSPECTION DATE DAY | MO | YR	AUTHORITY FOR INSPECTION
CAHN ENGINEERS INC	02JUN80	PL 92-367

REMARKS

END

FILMED

DTIC